ROADS and STR[illegible]

HIGHWAYS • BRIDGES • AIR FIELDS • HEAVY CONSTRUCTION

DECEMBER 1954

UNIVERSITY MICROFILMS
EUGENE B.POWER R6
313 N.1ST ST.
ANN ARBOR,MICH.
COMP-LRV-II-50

HUGE FILL BUILT LIKE A DAM

Continuously Reinforced Concrete Paving

Challenge to "Action" at AASHO

Acceptance Authorized Under Sec. 34.64 P. L. & R.

CARBIDE INSERT? or MULTI-USE

S. J. Groves & Sons Co. saves 15% in bit replacement and reconditioning with TIMKEN® carbide insert bits

LOCATION: Raven Rock, near Frenchtown, N. J.

OPERATING CONDITIONS: Hard shale and sandstone.

VARIOUS makes of bits were tested by S. J. Groves & Sons Co. while drilling in hard shale and sandstone on the Route 29A highway project near Frenchtown, N. J. The winner: Timken® carbide insert bits. They saved 15% in bit replacement and reconditioning over the others tested!

Timken carbide insert bits drill longer without sharpening. Bit reconditioning is minimized. Because of a special shoulder union developed by the Timken Company, threads are not subjected to drilling impact. And Timken carbide insert bits last longer, too, because they're made from electric furnace Timken fine alloy steel.

With Timken carbide insert bits, drillers can drill out full increments of drill steel in extremely abrasive ground where it is otherwise impossible. They give highest speed through hard, abrasive ground with fewer bit changes. And they're always your best bet for constant-gage holes, small diameter blast holes, and very deep holes.

But Timken carbide insert bits may not always be best for all your drilling jobs.

For drilling ordinary ground, Timken multi-use bits are most economical. With correct and controlled reconditioning, they give you lowest cost per foot of hole when full increments of steel can be drilled.

Both Timken carbide insert and multi-use bits are interchangeable in the same thread series. Drillers can change bit types quickly and easily as the ground changes—right on the job!

To find out which bit type is best for your drilling needs, consult the Timken Rock Bit Engineering Service. Write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

Timken threaded multi-use rock bit

Timken threaded carbide insert rock bit

your best bet for the best bit ... for every job

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

ROCK-RATED!

P&H MAGNETORQUE* gives highway work a new PUSH!

Friction-free swing speeds up digging cycle—gives you 20% more output.

BIGGER PRODUCTION FOR THE BIG ROAD JOBS AHEAD!

Make no mistake — outdated designs can't compete with these modern P&H machines! This is the time to convince yourself!

Watch a Magnetorque-equipped machine go through its paces. Note the smoother, faster swing! Compare the yardage! And remember, there's no time out for pampering swing friction clutches. P&H Magnetorque does it electro-magnetically. No friction — no wear. No bothersome adjustments. Magnetorque lasts the life of your machine.

Strength? These machines are built as only P&H can build them — all welded throughout of tough, rolled alloy steels.

They're ROCK RATED . . . ready for the repeated shock loads that wear down less rugged machines.

Ask us to tell you where you can see the nearest P&H 955-A or 1055 at work.

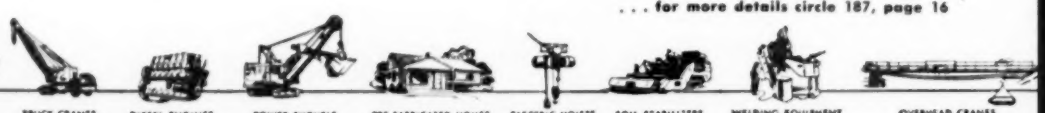
P&H POWER SHOVELS AND CRANES

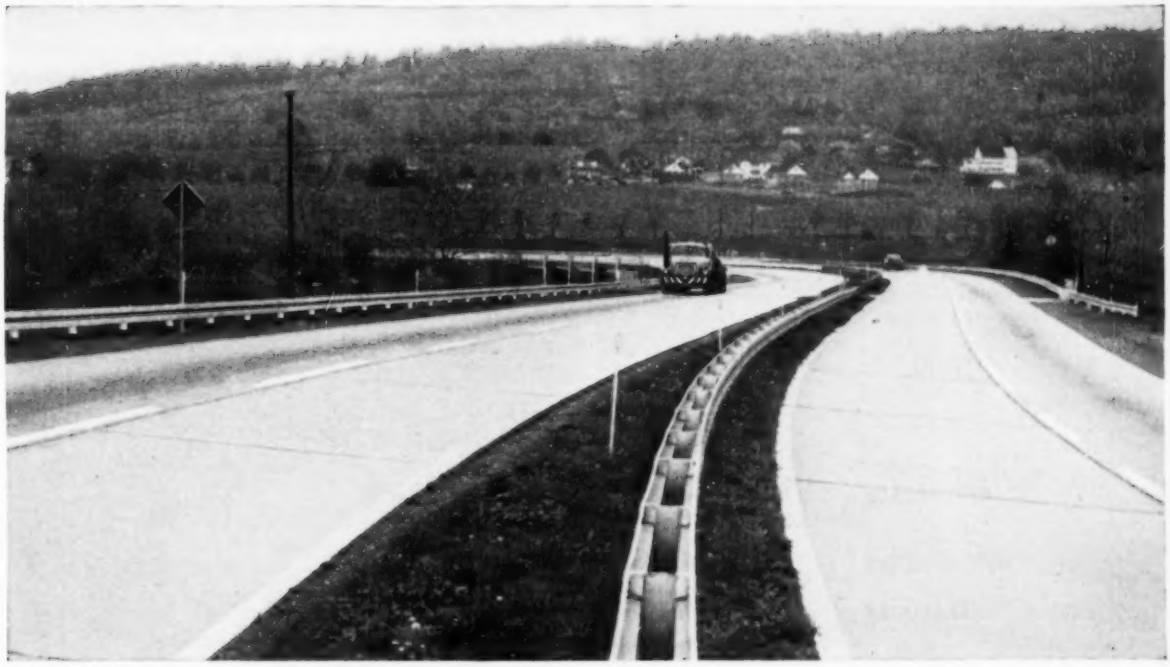
HARNISCHFEGER CORPORATION MILWAUKEE 46, WISCONSIN

*T.M. of Harnischfeger Corporation for electro-magnetic type coupling.

. . . for more details circle 187, page 16

the P&H Line





Safety-Beam Guard Rail

on Pennsylvania Turnpike near Reading

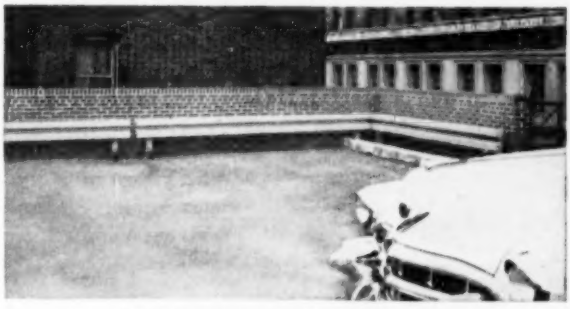
The above picture, taken along the Pennsylvania Turnpike, shows four strips of Bethlehem Safety-Beam Guard Rail. At the left, Safety Beam is protecting vehicles from a steep drop. In the center, a double line of Guard Rail forms a continuous impact-absorbing medial-strip divider. At the right, motorists are protected by Safety Beam installed on a dangerous curve.

Bethlehem Safety-Beam Guard Rail is made of sturdy sections of steel plate, bolted together on steel, wood or concrete posts. It bolts flush end-to-end, making one continuous beam, a factor which greatly simplifies installation on sharp curves.

What's more, Safety-Beam is easy to install, even by unskilled labor. No end anchor rods, special tools or complicated adjustments are required.

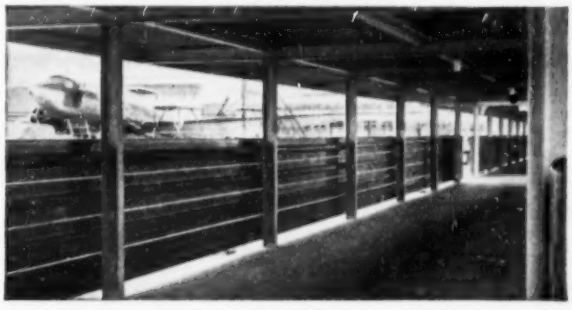
For more information about this and other steel products for highways, call the Bethlehem Sales Office nearest to you, or write direct to us at Bethlehem, Pa.

Besides protecting motorists at highway danger spots, Safety-Beam Guard Rail is used effectively in other protection-giving applications.



Parking garage roof in Atlanta, Ga.

Protected walkways for passengers at Shreveport, La., Airport.



BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

. . . for more details circle 168, page 16

ROADS AND STREETS

Devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations; the construction and maintenance of airports. Represents 62 years of continuous publishing in the highway field; combined with Engineering & Contracting and Good Roads Magazines, established in 1892.

DECEMBER, 1954 • VOL. 97 • NO. 12

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WATER AND RUBBER JOIN FORCES

PREPARING SITE FOR 6,500,000-YARD DAM!

THEY TOOK A TIP FROM THE FORTY-NINERS at Cherry Valley Dam, now rising in California's Sierras — for much of the overburden clung to slopes too steep for equipment. So they washed it down into the valley with high-pressure water jets, which also were used to wash out fines (as shown above). Then crawlers and the following rubber-tired equipment took over—15 scrapers, 35 haulers, 3 water trucks, 3 compactors, 14 pickups, 2 grease trucks, 3 flat-bed trailers and a couple of tank trucks. The mountain goats would hardly know the old place now!

BIG TIRE STOCK PILE ON JOB speeds changes for inspection and maintenance.

You find "Goodyear is there" on more and more jobs where the going is rugged—and there's no time for down time. That's because Goodyears, always tough brutes, are now more enduring than ever—for they're made with Goodyear's new, exclusive, Triple-Tempered (3-T) cord!

This patented 3-T process keeps Nylon or Rayon cord at its most bruise-resistant, heat-resistant point. It controls tire growth, reduces tread and body failures to new LOWS—keeps tires in shape for *extra* re-lugs and recaps. Next time you buy or specify any type tire, remember *only* Goodyears have 3-T Cord! Goodyear, Truck Tire Dept., Akron 16, Ohio.

HARD ROCK LUG

HARD ROCK RIB

ALL-WEATHER

SURE-GRIP

FOR EACH JOB, THERE'S A COST-CUTTING GOODYEAR TIRE!

GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

And Remember

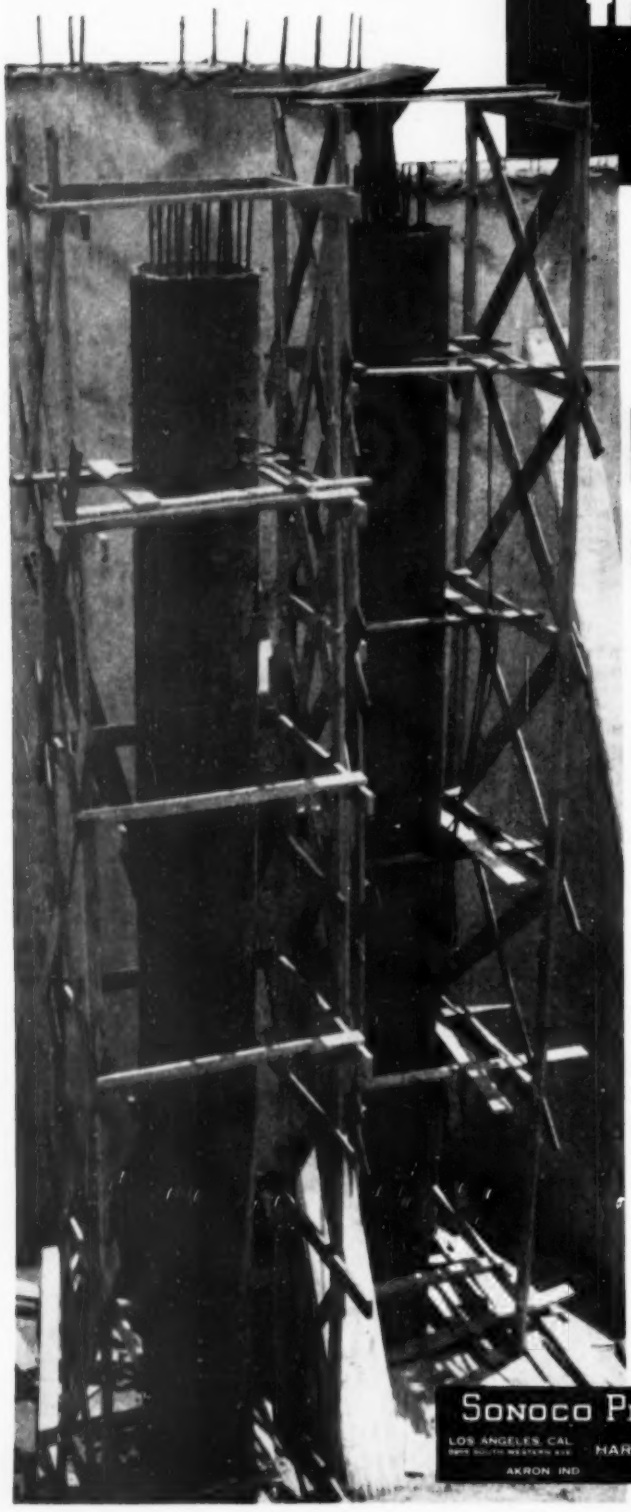
NOTHING ELSE CAN TAKE IT LIKE 3-T NYLON!

Sure-Grip, All-Weather —T, M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

. . . for more details circle 185, page 16

Englewood switch yards "crest bridge", Houston, Tex. Schwope Brothers, Houston, Tex., Contractors

Formwork for these columns costs less!



Sonotube®

FIBRE FORMS

for round columns of concrete

Round concrete columns being erected as part of this "crest bridge" over railroad tracks in Houston, Texas are formed with low cost SONOTUBES.

The fibre forms used on this job are 29′ long and 30″ inside diameter.

SONOTUBE Fibre Forms take less time to erect because they require only minimum bracing . . . take fewer men to handle because they are lightweight. SONOTUBES save time, money and labor!

Approved by contractors, engineers and architects everywhere. SONOTUBES provide a fast, economical means of erecting round concrete columns.

Supplied in specified lengths up to 50′ or can be sawed to your requirements on the job. Available in 31 sizes, from 1″ to 36″ I.D.

See our catalog in Sweet's

For complete technical data and prices, write

SONOCO PRODUCTS COMPANY
Construction Products Division
LOS ANGELES, CAL. — HARTSVILLE, S. C. — MAIN PLANT — MONTCLAIR, N. J.
AKRON, IND. — BRANTFORD, ONT.

sonoco
PAPER CARRIERS
REG. U.S. PAT. OFF.

. . . for more details circle 210, page 16

On the West Virginia Turnpike

a D7 with sideboom cuts rocks down to size!

For a tough job on the West Virginia Turnpike, Oman Construction Co., Nashville, Tenn., used a strong-armed Caterpillar team.

The job was to push up a 20-foot-high fill for an underpass. Rock was brought in at the rate of 275 loads a day. But specifications were rigid on the size of rock to be used in the fill.

So Oman put a 5000-pound weight on the sideboom of a pipe layer-equipped CAT* D7 Tractor to break rocks to required size. This is an example of the versatility of these units which can lift many tons with ease. Cat Pipe Layers are essentially mobile cranes which can get in and out of rough ground conditions while carrying loads. There are five models available with lifting capacities up to *83,600 pounds.*

In addition to the D7 working with the sideboom unit, Oman had on the job seven DW21s, more than twenty D8s and three No. 12 Motor Graders.

Everywhere along the rugged, mountainous terrain of the 88-mile West Virginia Turnpike contractors had similar Caterpillar-built fleets.

Job-wise contractors know it makes sense to standardize on Cat equipment. Not only do you have equipment that can handle a variety of jobs without costly down time, but operators and mechanics become familiar with one make. And, of course, you have the advantage of one-stop service from one dealer.

He's the man to see when you have important work coming up. He has field-proven equipment to fit any job. And he'll be happy to prove it—on your job.

Caterpillar Tractor Co., Peoria, Ill., U.S.A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

NAME THE DATE... YOUR DEALER WILL DEMONSTRATE

. . . for more details circle 172, page 16

GULF PRODUCTS *and* FINE SERVICE

keep equipment rolling on New York State Thruway

Mount Vernon Contracting Co., S. A. Healy and M. A. Gammino Construction Co., Mount Vernon, N. Y., have combined to handle grading, paving, and construction of drainage facilities along a 1.89-mile section of the Thruway between Suffern and Ramapo, N. Y., and construction work on 5.26 miles of access roads. This joint venture also involves the building of five highway grade separation structures, one combination highway and railroad separation structure, two bridges, interchange facilities between the Thruway and Route 17, and relocation of the Ramapo River. Work includes the excavation of 2,264,000 cu. yds. of earth and rock.

THE New York Thruway is another tremendous and important project where Gulf tops the list of suppliers of petroleum products. Twenty leading contractors on the Thruway, with a total of 43 jobs, rely on Gulf to help keep equipment delivering top performance.

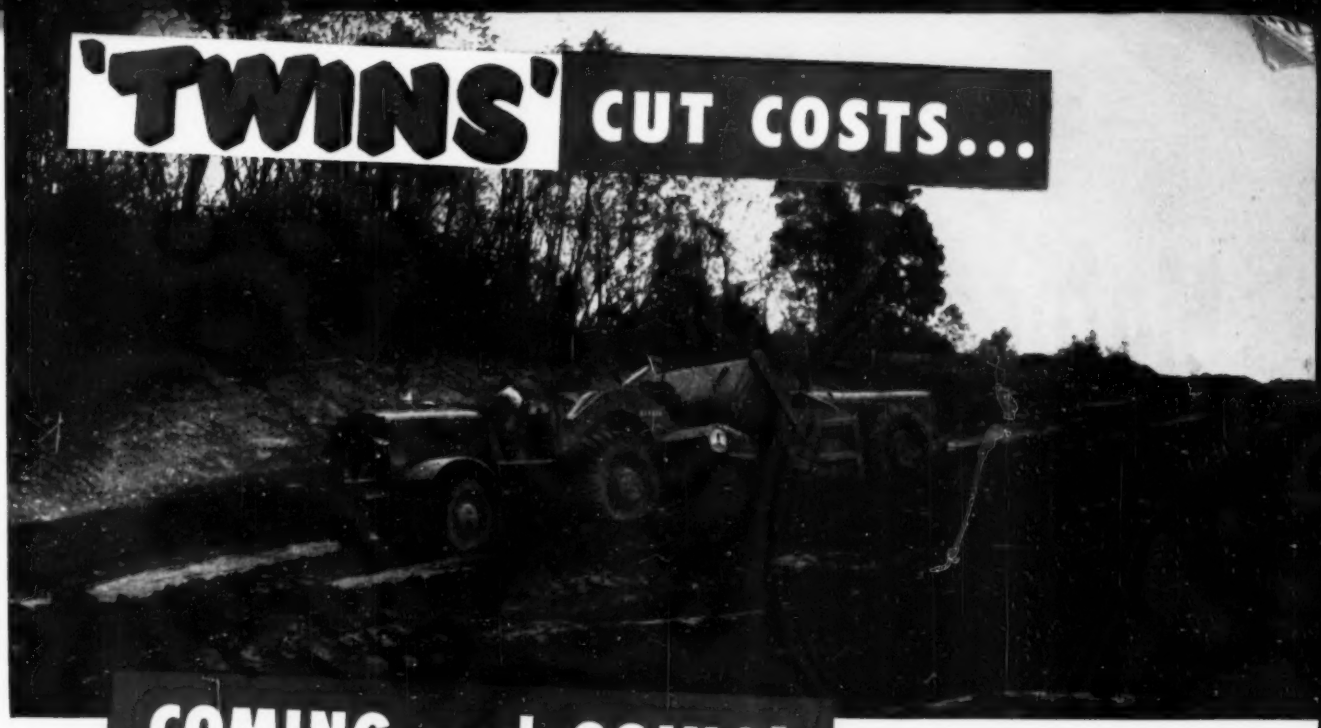
Mount Vernon Contracting Co., S. A. Healy and M. A. Gammino Construction Co., for example, know from experience that Gulf quality lubricants provide better protection against mechanical delays. And that Gulf fuels help them gain an extra margin of engine power and efficieny. Then too, they appreciate the helpful engineering counsel that Gulf provides, as well as Gulf's prompt delivery service.

Let us discuss with you how Gulf products and service can help you on your next job. They are available to you through more than 1400 conveniently located warehouses. Gulf Oil Corporation · Gulf Refining Company, 1822 Gulf Building, Pittsburgh 30, Pennsylvania.

GULF

. . . for more details circle 186, page 16

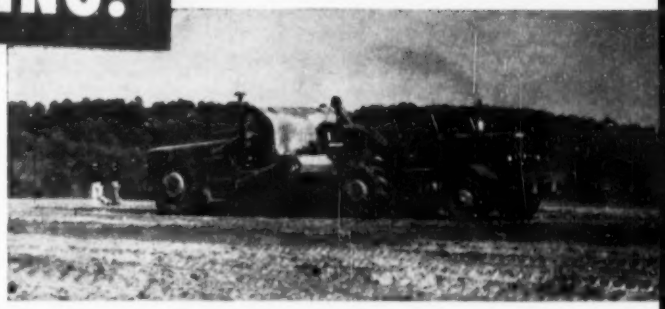
'TWINS' CUT COSTS...



COMING and GOING!

Because of their tremendous power and traction, Euclid Twin-Power Scrapers get big loads easier and move more pay yards per hour than any other scraper of comparable size . . . they maintain high production on jobs where other scrapers just can't operate efficiently.

On a 2½ million cu. yd. section of the New York Thruway near Kingston, John Arborio, Inc. has used 7 "Twins" to move extremely difficult material . . . ranging from river sand to wet clay. On a complete cycle of about 8,000 ft. the "Eucs" moved up to 40% more bank yards per hour and maintained average travel speeds 2 m.p.h. faster than "high speed" competitive scrapers. The "Twins" had plenty of power and traction to haul loads of 17 bank yards on grades up to 20% . . . they made the return trip from the fill in a hurry, too, thanks to their two engines with separate Allison Torqmatic Drives. Arborio also used a Euclid Loader with a large fleet of Bottom-Dumps, and Rear-Dump "Eucs" on this job.



Owners everywhere say the Euclid Twin-Power Scraper is the most versatile "one man earth moving spread" they've ever seen. If you haven't seen "Twins" in operation, ask your distributor for a copy of the new descriptive folder, Form 551, before you bid your next job.

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE

GM GENERAL MOTORS

ADAMS

Motor Grader with Elegrader

Plows and loads clay at rate of 10 yards per minute

The Adams Motor Grader-Elegrader combination pictured above is owned by a prominent contractor. It is shown here loading fill material out of a borrow pit. Cutting up to 24″ deep and 12″ wide, the outfit plows clay and loads trucks at the rate of 10 yards per minute.

On such jobs as loading, stripping, casting in new roads, terracing, etc., this great Adams combination is unsurpassed for economy of operation, ease of handling and dirt-moving ability. On jobs where it has no application, the Elegrader can be easily removed and blade put on for normal grading operations.

Let your local dealer show you how an Adams Motor Grader with Elegrader will step up production, cut costs and increase profits for you.

J. D. ADAMS MANUFACTURING CO. · INDIANAPOLIS, INDIANA

ADAMS

Motor Graders TraveLoaders Pull-Type Graders

. . . for more details circle 141, page 16

Choose the hoist with 9 lives...

CHOOSE HERCULES—Whatever the type or capacity of the next dump truck hoist you buy, the name HERCULES is your strongest guarantee of top performance and long life. From coast to coast, Hercules Hydraulic Hoists are favorites because they have earned the reputation of having 9 *lives*. Owners are continually amazed at the ability of Hercules Hoists to withstand severe use and to outlast other makes without repair.

One of the famous Hercules Hoists is the Model 100 for 8 to 11 ft. dump bodies. Here are nine reasons why the Model 100 has nine lives, and why you should make it your next choice in this work range:

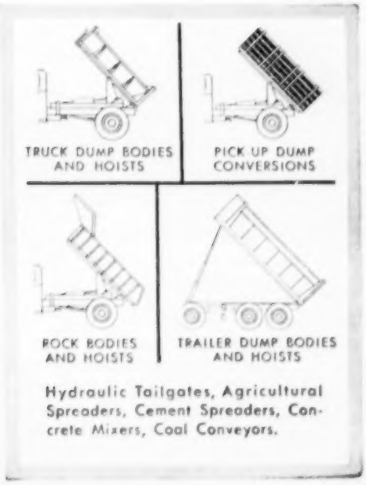
1. Takes more overloading
2. No cramping nor strain on hinge bolts.
3. Lift arm design keeps body from tilting farther than intended.
4. No hoist stresses except direct lift transmitted to truck frame.
5. Uniform oil pressure.
6. Maintenance requirements are minimum.
7. Every part can "take it"—no Achilles' Heel.
8. Precision built of highest quality materials.
9. Rigidly inspected at every step of production.

8358

BUY FROM THE LINE OF STRONGEST DESIGN

Hercules

HOISTS AND DUMP BODIES FOR EVERY NEED



Hydraulic Tailgates, Agricultural Spreaders, Cement Spreaders, Concrete Mixers, Coal Conveyors.

HERCULES STEEL PRODUCTS CORPORATION • GALION, OHIO

. . . for more details circle 188, page 16

SHOVEL-CRANE REPORT ON THE OHIO TURNPIKE

Sub-contractor Al Johnson Construction Co., Minneapolis, Minnesota, uses a 30-ton Lorain Moto-Crane, model MC-524, on their contract to dig footings for the 154 ft. Black River Bridge in Elyria. All in all, they have purchased seven Lorains.

MORE THAN 50 LORAINS SO FAR

ON *ALL* PHASES OF CONSTRUCTION

A Lorain took the first bite of earth at the ground-breaking ceremonies for the Ohio Turnpike. Since then, more than 50 additional Lorains have gone to work to rush completion of this vast 241-mile superhighway by October, 1955. Lorains of all sizes and types—shovels, cranes, clamshells, draglines, hoes—on rubber-tires and crawlers (up to 61 tons capacity)—are fitting the needs of a long list of big-name contractors on this big job. In the rubber-tire class alone, Lorain Moto-Cranes outnumber all other makes combined.

Your jobs may not be Turnpikes, but you, too, can profit by the same Lorain advantages so well known to men that must beat the *big* deadlines at a profit. See your nearby Thew-Lorain Distributor now . . . learn all the reasons why a Lorain is your best buy.

▲ More than 25 rubber-tire Lorain Moto-Cranes speed up and down the right-of-way to get work done. Sub-contractor Vogt & Conant, Cleveland, Ohio, 10-time Lorain owner, uses a 20-ton Lorain Moto-Crane to set 15-ton, 60 ft. long steel girders for this overpass. In the background, a 22½-ton, model MC-424 Moto-Crane, owned by Peter Kiewit Sons Co., uses a 1-yd. concrete bucket to pour abutments. Kiewit has purchased 36 Lorains.

A Lorain-820 Shovel, equipped with 2½-yd. dipper, is shown below digging a rock cut on another section of the Ohio Turnpike. ▼

◀ A Lorain crawler dragline handles ditch excavation as part of important drainage construction along 241-mile road.

Harrison Construction Co., Pittsburgh, Pennsylvania, have purchased a total of 55 Lorains. Below, one of their 1-yd. Lorain-50 Hoes digs a trench for a 36" corrugated cross-drain on one of their three contracts that total $9 million. ▼

OHIO TURNPIKE FACTS AND FIGURES

Estimated quantities:

Earth and rock excavation	29,500,000 cu. yd.
Fill or borrow	46,900,000 cu. yd.
Pavement concrete	7,860,000 sq. yd.
Bituminous shoulder surfacing	5,200,000 sq. yd.
Concrete in structures	582,000 cu. yd.
Steel	171,000 tons

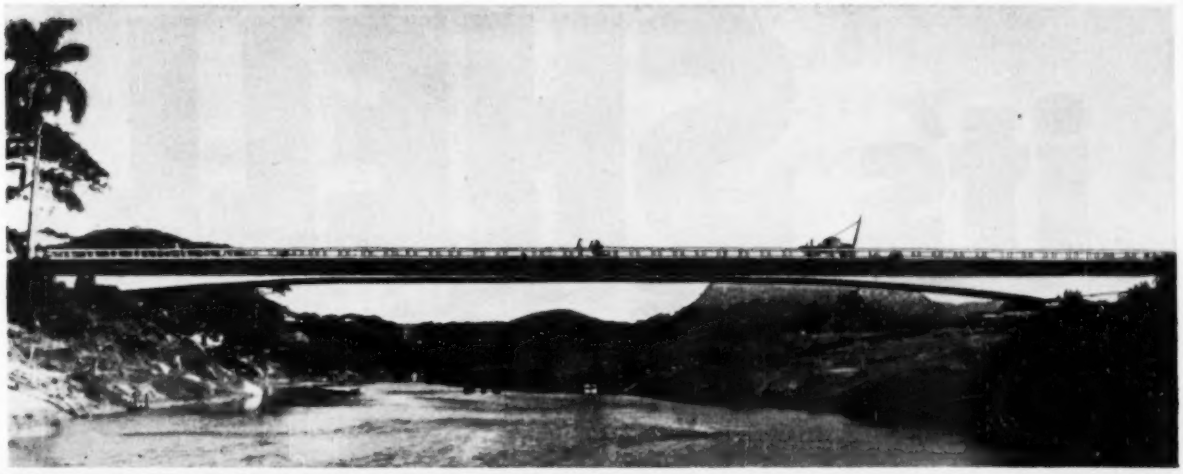
STRUCTURES:

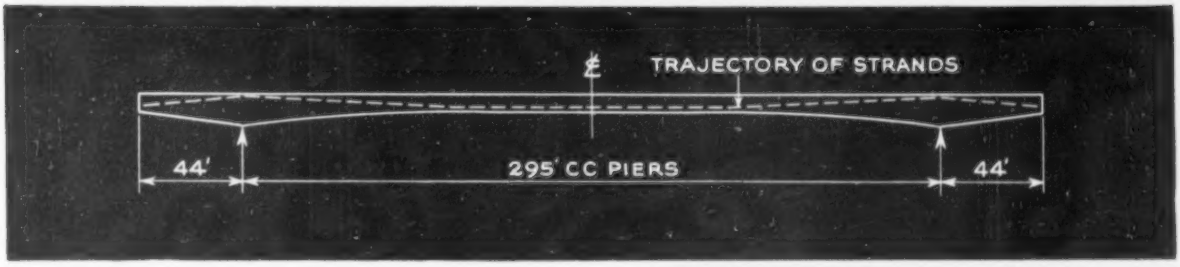
Bridges, drainage, overpasses, etc.	612

THE THEW SHOVEL CO.
Lorain, Ohio

THEW LORAIN®

LONGEST PRESTRESSED CONCRETE SPAN IN WESTERN HEMISPHERE





CUYAGUATEJE RIVER BRIDGE is the fourth maintenance-free prestressed concrete bridge completed in Cuba in the last two years – and also the longest and most graceful. The twenty-eight 1-11/16-inch diameter galvanized Roebling Prestressed Concrete Strands which provide the main tensioning force were coated with bituminous paint after erection and are expected to last indefinitely in the dead air space of the span's hollow box. They are readily accessible for inspection, however, and could be replaced at any future time.

The use of these Roebling Strands in a hollow box assures uniform tension by eliminating nearly all friction during the tensioning process. This is especially important for long spans carrying heavy loads, and for continuous structures where reverse curvatures create high friction in other types of tensioning elements.

Roebling engineers, pioneers in the development of prestressing techniques and tensioning elements in America, are always ready to offer suggestions to help attain best results on any prestressed concrete application. Write Construction Materials Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

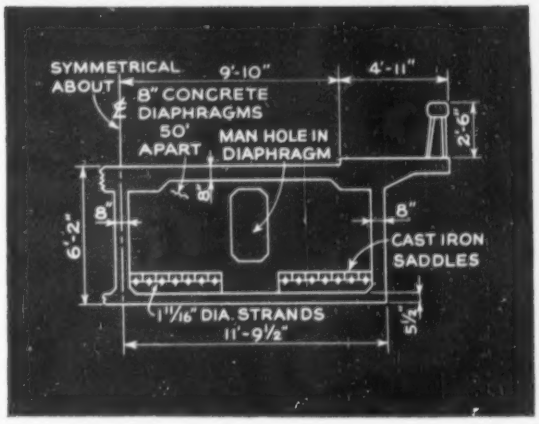


Photo: This graceful prestressed concrete hollow box spans the Cuyaguateje River near Pinar Del Rio. Main span, 295 feet center to center of piers; overall length, 383 feet; live load, AASHO-H20-44 . . . *Top blueprint:* Dotted line shows trajectory of the prestressing strands. *Lower blueprint:* Cross-section at center of main span including location of strands and manhole in diaphragm.

Bridge designed by Comision De Fomento Nacional De Cuba under supervision of Ing. Civil Luis Saenz, Designer and Chief Engineer; constructed by Compañía Constructora Munilla, Ing. Civil Fernando Munilla, Director.

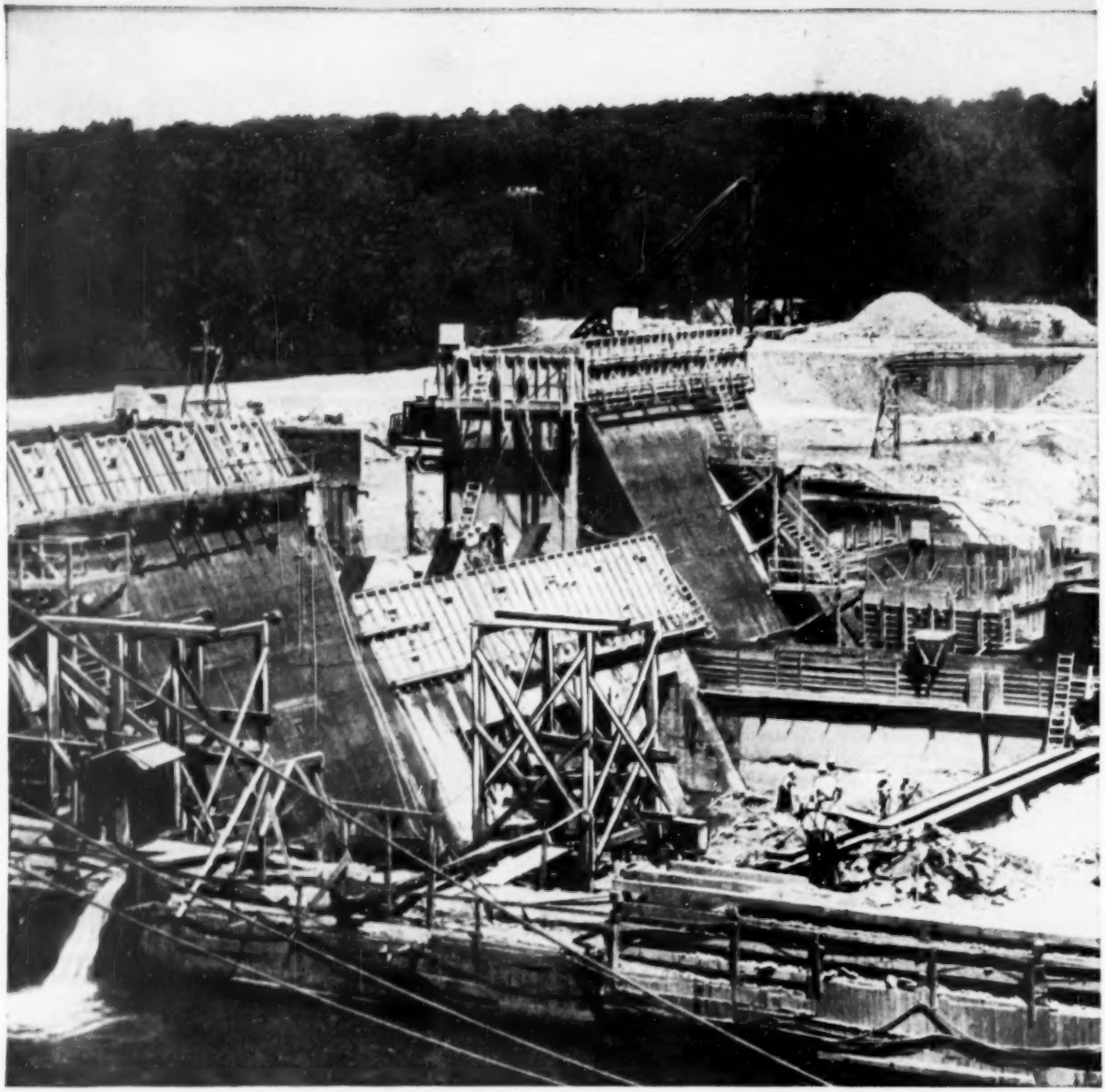
ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

. . . for more details circle 206, page 16

On VEPCO'S Roanoke Rapids, N. C.

it's SHELL.*



Hydroelectric project . . .

Gasoline
Fuel Oil
Diesel Fuel
Kerosene
Industrial Lubricants

Solvents
Motor Oils
Anti-Freeze
Greases
Outboard Motor Oil

The Roanoke Rapids Project for the Virginia Electric and Power Company, being constructed by Stone & Webster Engineering Corporation, is going full speed ahead. This extensive job keeps hundreds of pieces of heavy construction equipment busy, day and night. Nearly 100% of this equipment relies on Shell Industrial Lubricants and Fuels to meet the rigorous operating conditions.

When completed, Roanoke Rapids project will supply 100,000 kilowatts of electricity for Vepco's system.

Widely used in construction work and wherever heavy duty equipment operates, Shell lubricants protect machinery and at the same time keep maintenance costs at rock bottom. Perhaps it will pay *you* to look into the savings of a 100% Shell program.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, N. Y.
100 BUSH STREET, SAN FRANCISCO 6, CALIF.

*A diligent search could uncover only one piece of Vepco's equipment NOT using a Shell product.

. . . for more details circle 209, page 16

WHAT'S NEW in Equipment and Materials

Cat No. 12 Motor Grader Has Increased Power

Increased horsepower is one of the several improvements in the No. 12 motor grader of the Caterpillar Tractor Co., Peoria, Ill. The improved No. 12 packs 115 HP. In addition the clutch and transmission have increased capacity to match the greater horsepower. In both the Cat No. 12 and No. 112, convenient one lever from-the-seat starting is now available. The No. 12 and No. 112 are also equipped with accelerator-decelerator pedals that permit changing speeds without changing the throttle setting. The new throttle is a free moving non-ratchett type and the instrument panel is located to the right of the operator for greater visibility.

For more information circle 101 on Service Coupon this page and mail now.

Rugged New Truck Tire

A new truck tire, called the U. S. Royal, introduced in the competitive truck field by United States Rubber Co., Rockefeller Center, New York 20, N. Y., has a wide, rugged, five-rib tread, with extra-sharp tread edges and irregular grooves that give excellent traction on slippery surfaces. Contact area with the highway is relatively large, which helps to reduce uneven wear. The new tire is being made in a wide range of sizes from 6.00-16 with 6-ply rating through 10.00-22 with 12-ply rating. The new tire has a tough heat-resistant rayon cord construction that stands up under constant punishment. A special plastic-resin coating bonds the rubber and fabric into a very strong carcass that is also suitable for recappings. Double shock-pads are used to absorb road shock and reduce road failures.

For more information circle 102 on Service Coupon this page and mail now.

Quick Discharge Valve for Truck Tanks

A completely new stainless steel discharge valve for use on all types of truck tanks is now available. Designated as the Chem-Valve, it is claimed to eliminate such troublesome problems as clogged outlets caused by congealing liquids and the heating of these outlets before unloading. New illustrated color folder gives complete details. Tells how you can save many hours by speeding up unloading of bulk liquids. Parts, price lists and mounting instructions are also included. Write to Chem-Valve Corporation, 51 Bershire Valley Rd., Kenvil, N. J.

For more information circle 103 on Service Coupon this page and mail now.

Two New Light Duty Hoists

Two new low cost, light duty, single drum hoists have been developed by the O.K. Machinery Division of John C. Motter Printing Press Co., Columbia, Pa. Each of the new O.K. hoists, the J-8 and the J-15, are rugged yet light in weight so they may be easily moved. Special features are anti-friction bearings and fabricated steel side frames, both of which contribute to holding the amount of "Down Time" to a minimum. The J-8 has a standard line speed and load capacity of 125 ft./min. at 1300 lb.; the J-15, 150 ft./min. at 2000 lb.

For more information circle 104 on Service Coupon this page and mail now.

Vibrator Head Has Interchangeable Tips

A new high speed vibrator head with interchangeable tips has been developed by Stow Manufacturing Co., 65 Shear St., Binghamton, N. Y. One tip is made of hard rubber for use where plywood forms are being used. The other is made of tool steel for long wear. The tips can be screwed or unscrewed easily with a wrench. A patented nylon plug holds the tip securely in place in spite of the continuous vibration. This new head is 10 in. long and is available in diameters of 1¾ in., 2 in. and 2½ in. They can be run as fast as 9,000 rpm. The outside shell is case-hardened for long wear. The vibration is caused by an eccentric weight which is mounted in special high speed duplex ball bearings at each end. A high speed shaft seal retains the oil lubricant for life.

For more information circle 105 on Service Coupon this page and mail now.

More equipment news on pages 58-61, 84-86

Special Purpose Batch Body

A new special purpose batch body announced by Galion Allsteel Body Co., Galion, O., is designed for delivering measured quantities of cement and aggregate to concrete mixers on highway construction projects. The new body is divided into 4 aggregate compartments by waterproofing batch boxes. Hinged covers on the boxes keep cement dry during inclement weather. Likewise, a full-width hinged bottom plate on each box is said to assure even distribution of cement over the aggregate during discharge. Boxes are easily removable to permit use of the dump body for material stockpiling. Mounted on a Model 880 hoist, the 11 yd. Model 12N-7 batch body shown has a capacity of 54 cu. ft. in each aggregate compartment and 18.6 cu. ft. in each cement batch box. Model 12N-5 batch bodies are also available in 9 to 11 cu. yd. capacities.

For more information circle 106 on Service Coupon this page and mail now.

For more items . . . . . see page 58

MAIL THIS COUPON TODAY!

ROADS & STREETS
22 West Maple Street
Chicago 10, Illinois

CIRCLE THE NUMBERS AND MAIL NOW!

Please send me further information on products and materials mentioned in the December Roads & Streets as circled below:

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NOT GOOD AFTER JANUARY 15, 1955

A READER SERVICE FOR YOUR NEEDS

How to get BIGGER output on BIG trench hoe jobs

K-370 DEEP-DIGGING TRENCH HOE DELIVERS MORE YARDS PER SHIFT. Sewer jobs like this are completed faster because dig-swing-dump cycles are much smoother. Operator has perfect "feel" of load as he operates conveniently located short throw Speed-o-Matic levers. Gooseneck hoe boom gives superior digging-dumping action.

13.823

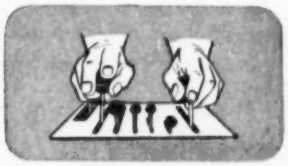
LINK-BELT SPEEDER CORPORATION, Cedar Rapids, Iowa

K-300 series machines offer extra capacity and power PLUS *Speed-o-Matic* control

FIELD reports show that outfits using K-300 rigs have a decided advantage in bidding and *getting* the BIG jobs—at a profit! *Greater output* does it!

Extra work capacity of K-300 rigs is a combination of many things. Speed-o-Matic power hydraulic control keeps operator far fresher, more alert all day. Means greater output—up to 25% more buckets delivered.

K-300's greater power (142 usable hp) speeds digging because it minimizes stalling, produces smoother swings. Add to this the stamina and more *"live weight"* that permit continuous operation under full power month after month. No wonder owners say the K-300 is the best producer money can buy! See your distributor or write for K-300 series literature now.



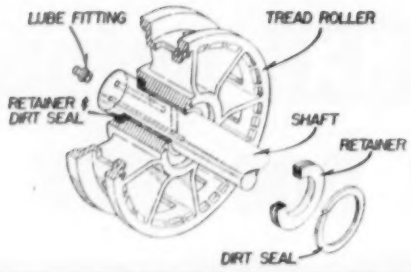
Speed-o-Matic is today's fastest, easiest-to-operate and most trouble-free control system. Now standard on *all* Link-Belt Speeders.

Note the size, weight and heft built into the working parts and structure. More "live" weight permits more efficient use of extra horsepower.

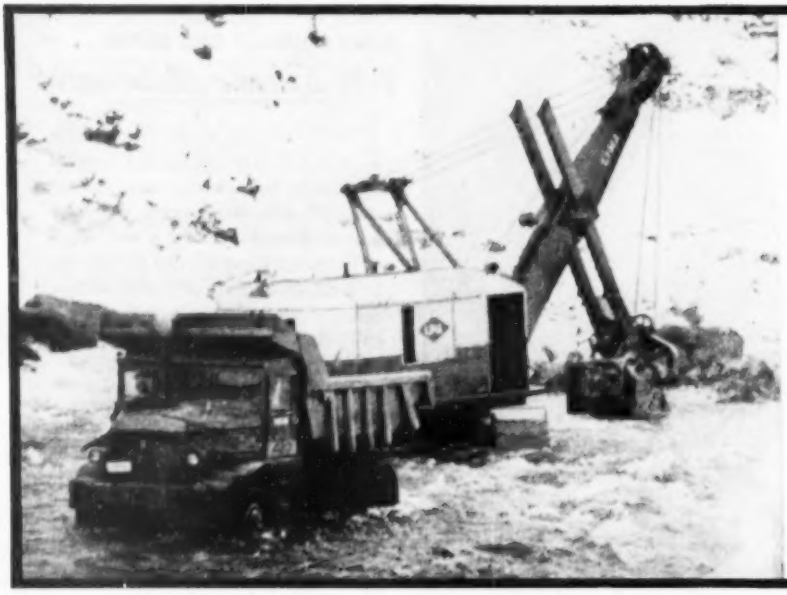
BUILDERS OF A COMPLETE LINE OF CRAWLER, TRUCK AND WHEEL-MOUNTED SHOVEL-CRANES

LINK-BELT SPEEDER

. . . for more details circle 194, page 16



LIMA DIRT SEALS CUT DOWN-TIME AND MAINTENANCE COSTS



This LIMA shovel, demonstrates the importance of LIMA'S dirt seals and grease retainers.

In such work, abrasive material which wears out the bushings and shafts of ordinary shovels is excluded. LIMA seals the lubricant in and dirt out, thereby reducing friction and prolonging the life of bushing, roller and shaft.

COMPARE! No other machine gives you as much as LIMA!

1. Bronze bushings in tread, idler and drive rollers are protected by piston-type dirt seal rings and retainers.
2. All gears, smaller parts and shafts which are subject to extra wear are flame or induction hardened for longer life.
3. Main machinery is placed well back of center of rotation to eliminate excess counterweight.
4. Anti-friction bearings, used at all important bearing points, reduce destructive friction, fuel consumption and lubrication requirements.
5. Big capacity drums and sheaves lengthen cable life by reducing the need for double wrapping and sharp bends in cable.
6. Full air controls on travel, hoist, swing and boom hoist, result in smoother, more precise operation, minimum maintenance and less operator fatigue.
7. Torque converter (optional) automatically adjusts speed to load requirements, minimizing shock loading, making performance smoother and faster.
8. Wherever you are, you can depend on skilled service and nearby warehouse stocks of parts to keep your LIMA on the job continuously.

COMPARE and you'll specify LIMA for shovels (¾ yd. to 6 yds.), cranes (to 110 tons) and draglines (variable).

DISTRIBUTORS IN ALL PRINCIPAL CITIES OF THE WORLD

LIMA
SHOVELS • CRANES
DRAGLINES • PULLSHOVELS

BALDWIN BLH LIMA-HAMILTON
Construction Equipment Division

BALDWIN-LIMA-HAMILTON CORPORATION
Construction Equipment Division
LIMA, OHIO, U.S.A.

. . . for more details circle 166, page 16

ROADS AND STREETS

Washington News Letter

By Duane L. Cronk December 8, 1954

The most exciting news in Washington is about to break - the Clay Committee report to President Eisenhower on the feasibility of his $50-billion highway proposal. Within the next few days, the five-man group will wrap up the eagerly awaited statement and send it across the street to the White House. The contents - bound to become highway history - may make headlines this month, or may be held for the "State of the Nation" address.

During this brief "betwixt and between" spell, a quick review of what has happened in the last six months indicates how fast and far the national highway problem has moved into the political limelight. On July 12, President Eisenhower called upon the assembled state governors to help devise a way to launch an additional $50-billion road building program. He cited the dependency of the nation upon highway transportation and the danger of highway obsolescence blocking further economic development.

The governors accepted the challenge and by the time this is read will have turned in their recommendations for action. In the meantime, the President appointed his own committee, under General Lucius B. Clay, to advise the Administration how to finance a 10-year road building program double the current volume.

The counsel of every major highway organization and numerous other bodies has been sought by this committee during the last three months. Its conclusions, now about to be reported to the Administration, will reflect the testimony of state highway officials, mayors, contractors, petroleum interests, truckers, farmers, bankers, and others.

The committee has indicated, although its recommendations are still unwritten, that it is seriously considering two of the most popular appeals made by both political and industry interests. They are:

- That the federal government issue $25 billion worth of bonds over the next ten years to finance half of the proposed program. The bonds would be backed by revenues from the federal gasoline tax.

- That top priority be established for construction now of the 40,000 mile national interstate system, and that Uncle Sam assume financial responsibility for the job which the Bureau of Public Roads estimated last month would cost $24 billion.

The effect on the economy of a $100-billion road-building program has been studied by the committee. The Bureau of the Budget has been consulted. So has

(continued on next page)

the Council of Economic Advisors. Nothing seems to stand in the way. For instance, gross national product will grow about 4% a year during the next decade. Present highway construction is only 1% of gross national product now, would grow to only 2% if doubled.

The engineering shortage, a major potential bottleneck, has been delved into by the committee. Its thinking is that that problem will diminish, if tackled from several different directions:

- Full utilization of engineering manpower in engineering work.
- Adoption of standardized designs.
- In-service training of engineering aides.
- Accelerated engineering courses in Junior Colleges.

The incentive of 10 years of steady work at good pay could be the greatest solution in itself.

The amount of ammunition to be available to Administration after the Clay Committee report seems overpowering. The most comprehensive surveys and financial studies ever undertaken by the BPR, the exhaustive testimony amassed by Congressman McGregor's House Committee on Roads last spring, the governors' poll, and the cumulative experiences of municipalities and states in their struggles to stem obsolescence will be in the President's hands this month to use as he wills.

* * *

No one seems very worried about how the new Democratic Congress will treat highway appropriations. Long-time Washington observer for the National Association of Manufacturers, Walter Chamblin, believes that more spending for highways will "probably be the one thing which Congress and the Administration will agree on completely."

Back at the reins as chairman of the Senate Public Works Committee (which will consider federal-aid to highways), Senator Dennis Chavez (D., New Mexico) declared, "Roads just aren't political. The farmer in Republican Wisconsin needs them as badly as the farmer in Democratic New Mexico. Personally, I'm for roads, roads, and more roads."

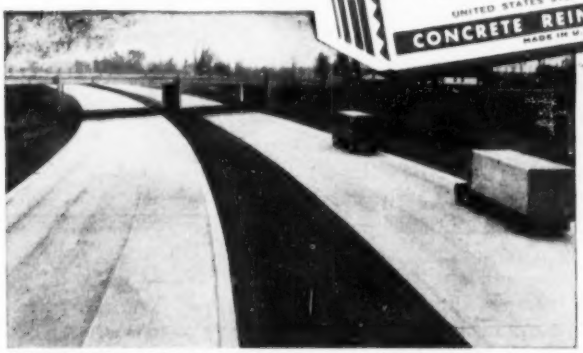
* * *

Contractors organizations in Washington were keenly interested in a little publicized report made at the recent AASHO meeting by C. W. McCaughey, chairman of a Subcommittee on Contract Maintenance. Some 24 states listed 70 maintenance items presently being let to contract by them - far more than a survey in 1952 revealed.

"It is the frank opinion of a majority of this subcommittee," Ohio State Highway Engineer McCaughey reported," that contracting costs are generally lower . . . that results are comparable or better, and that the contractor makes a profit . . ."

* * *

THE PENNSYLVANIA TURNPIKE was reinforced with American Welded Wire Fabric. American Welded Wire Fabric reinforcement prevents heaving, spalling, and pumping, assures peak road performance.



ILLINOIS STATE HIGHWAY ENGINEERS specified Welded Wire Fabric and Illinois Highway Contractors used American Welded Wire Fabric for the Edens Expressway, an important part of the highway network serving Chicago.

CITY STREETS, too, last longer and resist cracking better when reinforced with American Welded Wire Fabric.

Famous roads everywhere are reinforced with American Welded Wire Fabric

THE Pennsylvania Turnpike, The Edens Expressway in the Chicago area, the New York Thru Way, the Ohio Turnpike, and many other modern concrete roads are reinforced with American Welded Wire Fabric. This high quality reinforcement provides strength and shear resistance that not only meets, but *exceeds* standards set up by the new ASTM Specification A185-53T.

The manufacture of American Fabric is rigidly controlled to assure compliance with ASTM Specification. We take great care in making the steel, drawing the wire, and fabricating and testing the finished product. Quality inspections at every step of the way assure uniform wire size and spacing, sound welds, and great strength. All this adds up to greater assurance that your concrete will be as strong as it was designed.

Ask specifically for American Welded Wire Fabric. It comes in a style and size for every job, and assures good performance.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

EVERY TYPE OF REINFORCED CONCRETE CONSTRUCTION NEEDS

USS AMERICAN WELDED WIRE FABRIC

UNITED STATES STEEL

. . . for more details circle 163, page 16

The Facts Behind Allis-Chalmers Leadership in Torque Converter Tractors

***Fourteen* years of experience . . . *eight* years with production models**
. . . *thousands* of torque converter tractors out in the field . . .
***millions* of operating hours on every kind of work in the construction business.**

TODAY'S top contractors have given their "stamp of approval" to torque converter drive—as a key factor in the new standards of tractor performance they need for today's closely-bid jobs. Here's why —

Automatic Matching of speed and pull to load and terrain conditions . . . more dirt moved every hour, day in and day out.

Hydraulically cushioned protection for engine, clutch, transmission, rear end. The entire tractor lasts longer! That means less downtime, lower maintenance costs, more profit.

Operators love it! Allis-Chalmers torque converter tractors are so easy to handle (most shifting is eliminated) that operators do a top-notch job all day long.

Yes, the construction industry's most experienced men are demanding and buying torque converter tractors . . . *and in this, Allis-Chalmers leads the way.*

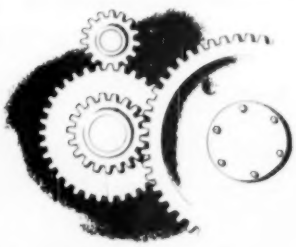
But, remember, you don't buy just one feature . . . you buy a *tractor*, with torque converter drive designed as a matched part of the entire machine. This advanced drive is only *one* of the many outstanding features that have switched so many leading contractors to Allis-Chalmers tractors. So . . .

Check all these features before you buy!

All-Steel Box-A Main Frame with one-piece, rear-end housing gives improved weight distribution, soaks up shocks, provides better equipment mounting, greater servicing ease . . . longer equipment life.

Service Simplicity of Unit Construction — Power drive components can be easily removed, repaired or replaced without disturbing adjacent parts . . . saving time and money.

"Live" Sprocket Shafts — "Live" shafts with straddle-mounted bearings permit small, more serviceable seals. Double reduction final drives with smaller gears and shorter, heavier shafts mean extra ground clearance, better alignment, longer life.



1,000-Hour Lubrication — Tapered roller bearings and positive seals on truck wheels, idlers, support rollers and final drives extend lubrication intervals, cut downtime.

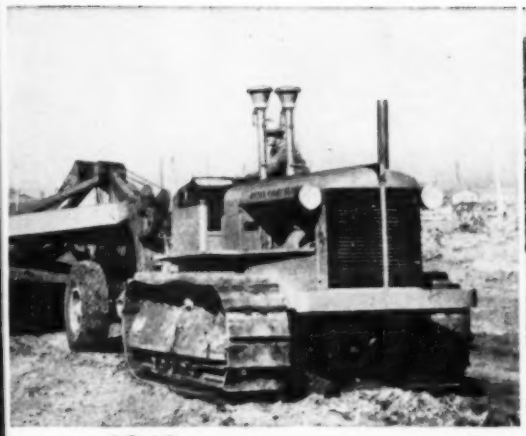
Hydraulic Booster Steering — Gives operator small tractor maneuverability with new ease. In addition, self-energizing brakes which take hold with a firm, uniform grip, provide exact control and sure safety with less pedal pressure.

True-Dimension Track provides maximum ground contact . . . plus the right design, the best steels for every job condition . . . heat-treated for long life with the industry's newest, most complete facilities.

Oil-Enclosed Track Release Mechanism — Operates in oil, seals out dirt and moisture, always in working condition to provide positive protection.

See your nearby Allis-Chalmers dealer now for the full story. Whether you're interested in a big tractor like the HD-20 or HD-15 . . . or the smaller HD-9 and HD-5, you can be sure of getting the most advanced tractor in the business, because Allis-Chalmers is the leadership line.

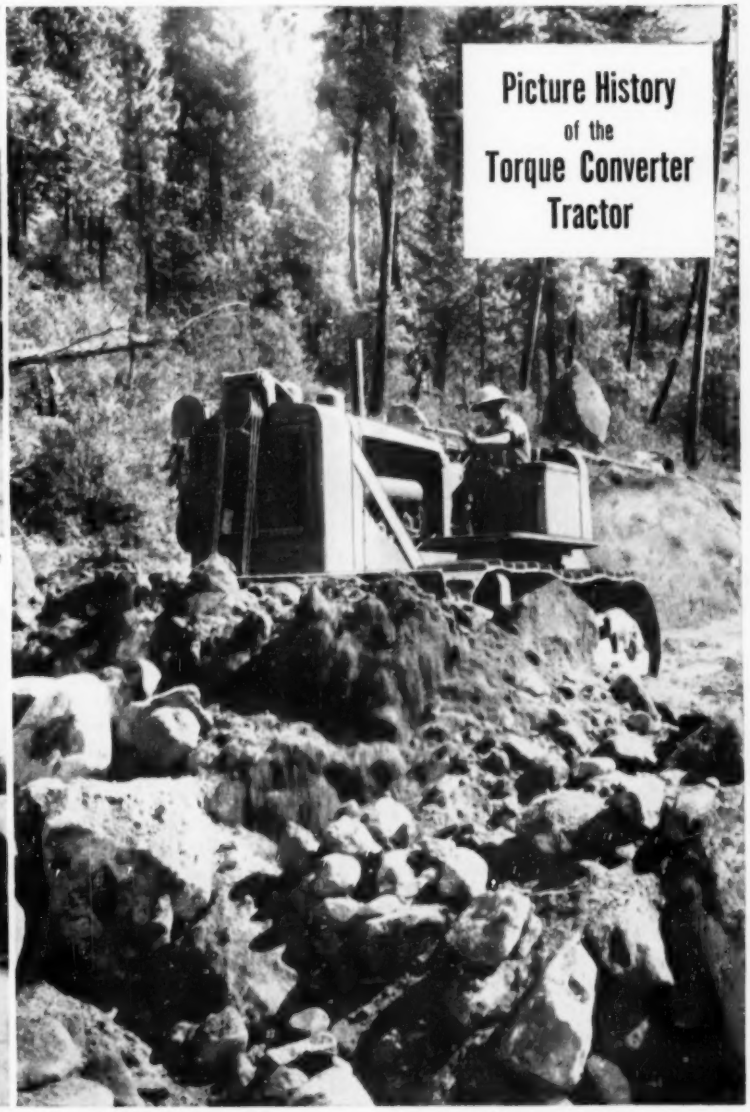
ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.



1940 THE FIRST tractor in the world with torque converter drive.

WORLD WAR II—The torque converter equipped M-4 military tractor, built by Allis-Chalmers.

1947 THE HD-19 proved the value of torque converter drive for big production.



Picture History of the Torque Converter Tractor

1951 THE HD-20, 175 net engine hp, most productive tractor in the business.

1954 THE HD-15C, 135 net engine hp, brings advantages of torque converter to a new range of work.

. . . for more details circle 162, page 14

PROFITABLE PRODUCER FOR OMAN
on the West Virginia Turnpike

For money-making production on its contract on the West Virginia Turnpike, Oman Construction Co., Nashville, Tenn., relied heavily on rugged yellow equipment. This high-speed, high-capacity 225-HP CAT* DW21 with No. 21 Scraper is one of the units in its line-up. Typical performance: along with another DW21 team and a D8 with No. 80 Scraper, this rig moved about 3500 yards of shale, sand and clay per 10-hour day over hauls of varying distances. Like Oman's other Caterpillar-built rigs, it worked day after day with a minimum of down time. In the background: a D8 with No. 8A Bulldozer.

What's back of the DW21's profitable performance? Among other factors, it's the *only* two-wheel earthmover designed and built by *one* company, with every part *matched* for maximum efficiency. Its capacity, speeds and power are *balanced for big production—loading, hauling, dumping.* For example, its capacity is 20 yards heaped, 15 struck. Its 2.16 m.p.h. in low gear matches push-loading speeds, and its 20.0 m.p.h. in fifth provides maximum practical off-road going. Its power is honest—225 HP at the flywheel that won't "smother" on adverse grades. Other advantages: Good visibility. A turning radius of 90°. Positive ejection that dumps even sticky materials fast. And hydraulic steering that gives the operator "feel of the road" control, an asset in tight spots and barreling along.

Another asset: Wherever a contract takes you, your nearby Caterpillar Dealer backs you up with prompt service—*on the job.* Ask him to show you performance figures on the fast-stepping, high-capacity DW21. Name the date—he'll demonstrate!

Caterpillar Tractor Co., Peoria, Ill., U.S.A.

CATERPILLAR*

*Both Cat and Caterpillar are registered trademarks—®

USE CAT EQUIPMENT FOR ON-SCHEDULE PERFORMANCE

. . . for more details circle 173, page 16

Huge Fill Built Like a Dam

By Fred D. Miles

Special Project Engineer, Palisades Dam Project, Idaho Department of Highways

Reviewing construction methods for 1,650,000 cubic yard earth embankment on U. S. 26 relocation at Palisades Dam in Idaho. Designed for partial inundation by the reservoir, this fill is believed to be the largest single embankment ever built in United States highway work.

THIS brief report describes the construction of what is believed to be the largest highway fill in the United States — a different kind of fill. It is on the 20-mile-long relocation of U. S. 26 where this highway was moved out of the valley to be drowned by Palisades Dam reservoir in southeastern Idaho. The dam is on the South Fork of the Snake River, 56 miles east of Idaho Falls and 15 miles from the Wyoming line. The relocation starts a short distance west (down-stream) of the dam and runs southeastward into Wyoming, along the north side of the reservoir-to-be. Incidentally, Palisades Dam, when completed, will be the largest earth-fill dam ever built by the U. S. Bureau of Reclamation — 14,000,000 cu. yd. of earth and rock. It will be rock-faced, 270 ft. high, 2100 ft. long at the crest, and 2100 ft. wide at the base (measured from upstream to downstream extremities.) Normal water level will be at elevation 5620, and the crest at elevation 5630 ft. above sea level. The reservoir will be

● Big Elk Creek Fill under construction seen from right abutment looking toward Stations 1221 to 1232. (Pics by Phil Merritt.)

● Drilling in rock cut at Big Elk Creek.

● Looking up the reservoir area from Sta. 1110 on newly relocated U. S. 26. Blasting and excavation work continues despite approach of winter.

● Fill as seen in September, 1953, from Station 1226.

● Jackhammer operator working on the rock face of the road cut adjacent to the main fill.

● Looking upstream at Big Elk Creek Fill. Seven 48-in. Armco cmp. culverts appear in center of photo. Clearing line appears in background.

21 miles long, extending 5 miles into Wyoming.

Between Sta. 1209+20 and Sta. 1221+00 (see Figure 1) is a highway fill built like an earth-fill dam. This fill, known as Big Elk Creek Fill, is 1180 ft. long and contains 1,655,246 cu. yd. of Zone 1 material, Zone 2 material, and dumped riprap. The contour map (Figure 2) shows the dam site, a portion of the present old road, the relocated road at Big Elk Creek Fill, and the dotted contour, 5620, of the reservoir normal water level. The reservoir water will be 140 ft. deep on both sides of this fill. Quantities and bid prices for the large fill and the highway contract are shown in the tabulations.

The Big Elk Creek fill is part of a project sub-contracted from Palisades Contractors by Kiely Construction Company of Butte, Montana. Kiely performed the work with the following major equipment units:

2 Northwest 80 D 2½-yd. power shovels
1 Koehring 1-yd. power shovel
17 Crawler tractors (9 with bulldozers) — Caterpillar D8's and a D6, Allis-Chalmers HD 19's and 20's
6 Caterpillar 25-yd. scrapers
3 Caterpillar DW10 scrapers
3 Caterpillar DW20 scrapers
2 Caterpillar No. 12 motor graders
3 Shovel Supply Bureau No. 2 sheepsfoot rollers
3 Euclid 25-yd. end dumps
9 Euclid 15-yd. end dumps
5 Euclid 15-yd. bottom dump wagons (12-in. side boards)
1 ripper
2 trailer type 2000 gal. water trucks
2 grease, oil, & tire service trucks
4 Gardner-Denver 600 cfm air compressors
5 Gardner-Denver wagon drills

Zone Construction

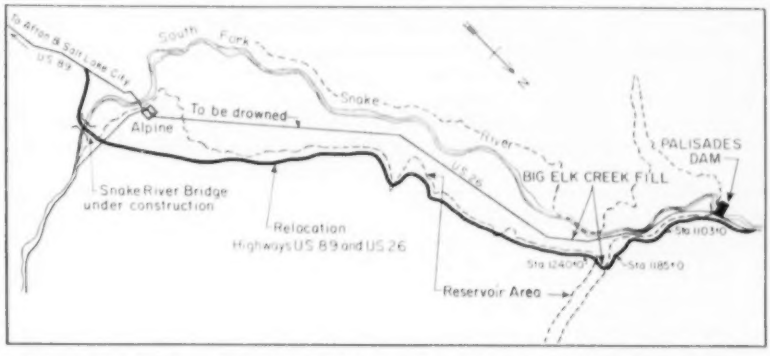
The fill design and construction are similar in many respects to that of the dam. It was divided into two zones and "dumped" riprap, Fig. 3.

Zone 1, corresponding to the inner core of a dam was placed, as shown, with side slopes of 1.4:1. The material used consisted of gravelly clay top soil from the highway cuts and roadside borrow pits. Specifications required it to be compacted to 95% of laboratory maximum dry weight density. Water was applied as directed by the engineer to obtain maximum density with the heavy sheepsfoot rollers being used. The fill was placed in layers and the layers were disced when necessary to be sure that the soil had a uniform moisture content. All water was metered and paid for at the bid price. The materials placed in Zone 1 were placed in 8 in. thick layers, and no stones 7 in. or larger could be incorporated.

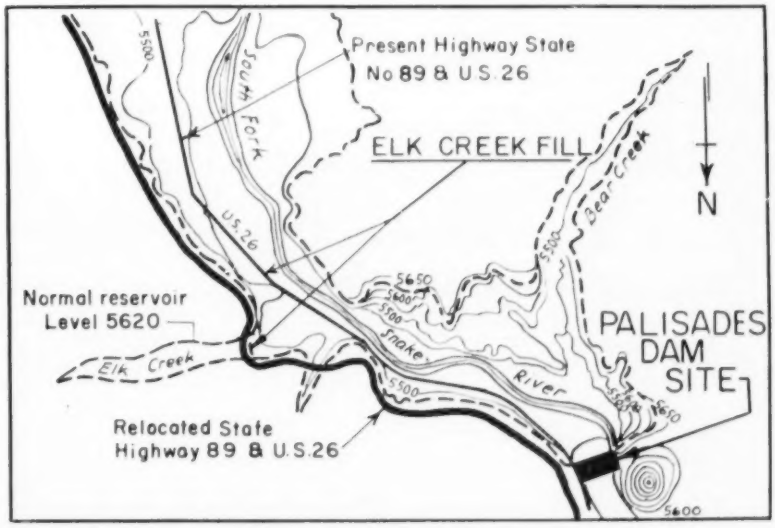
Zone 2, the outer flanks of the fill, consists of a pit-run gravel obtained from a borrow pit. It was placed in 12 in. thick layers and wet down. The compaction was obtained by 4 "passes" of the treads of a crawler type tractor weighing approximately 40,000 lb. One pass of the treads is defined as the required number of successive trips, which, by means of sufficient overlap, will insure complete coverage of an entire 12-in. layer by the tractor treads. No second pass was allowed until a first was entirely completed. No rocks exceeding 12 in. diameter were allowed in a layer.

"Dumped" riprap was blasted rock

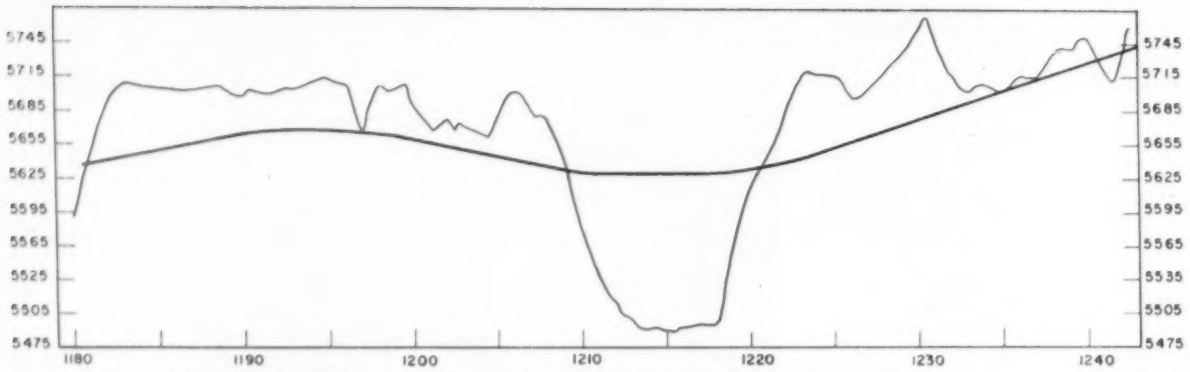
● Equipment loading material in cut at Station 1220+00 to 1227+00.



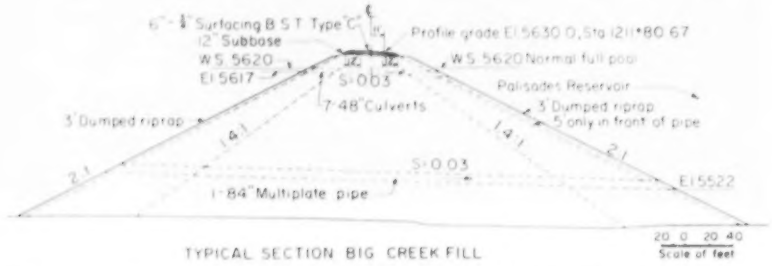
● Figure 1 — Showing relocation of highway along edge of Palisades Dam reservoir.



● Figure 2 — Contour details in vicinity of the big fill.



● Figure 4 — Profile along the large fill, giving idea of the size of the "hole" filled by the contractors.



● Figure 5 — Cross-section through center of Big Elk Creek Fill. Note zones, culvert location, and location of emergency culverts near top of fill.

Cost Breakdown of Big Elk Creek Fill Station 1209+20 through 1221+00

ZONE 1 MATERIAL	*Quantity*		*Amount*
From roadway excav.	425,226.0	c.y.	170,090.40
Borrow Area No. 2	86,696.0	c.y.	34,678.40
Borrow Area No. 3	270,027.0	c.y.	108,010.80
ZONE 2 MATERIAL			
From roadway excav.	114,966.0	c.y.	57,483.00
Borrow Area No. 1	392,701.0	c.y.	196,350.50
Zones 1 & 2 from roadway excav. (Part of item 193-Excav. Rock from Roadway)	307,915.0	c.y.	447,268.25
Dumped riprap (part of item 204)	57,715.0	c.y.	197,007.75
Watering			12,677.00
Rolling Embankment			36,540.00
Overhaul			50,786.23
	1,655,246.0	c.y.	1,337,158.29

$1,340,892.35 / 1,655,246.00 = $0.8101 /c.y.

from a cut on the roadway line near the fill. The largest rock in the riprap, classed as "dumped" riprap, was not over ½ cu. yd. in volume, and the rock was graded down uniformly to rock or spalls not less than ½ cu. ft. in volume. Any smaller material entering the shovel dipper was not permitted to exceed a quantity that would fill the voids in the riprap. Usually the rock was shot in such a manner that the shovel output readily met these specification requirements. The riprap was not required to be compacted; however, the contractor lowered a crawler tractor on a snub line from a parked crawler, equipped with a winch, on top of the grade and passed it up and down to level off the surface of the riprap. It was placed in a uniform 3 ft. thick layer, except for one place. Below the outfall ends of the seven 48-in. overflow pipes, the riprap was placed 5 ft. thick.

After the trees and brush were cleared from the mountainside cut areas, bulldozers cut a pioneer trail wide enough for scrapers to work. At the same time, draglines cleared the natural ground area of the fill, removing all muck, rotten timber, and organic matter. Scrapers dumped their loads along the edge of this dug out foundation, and bulldozers pushed the fill material into place. When it was up high enough material was compacted until the sheepsfoot rollers rode out.

Cost Breakdown Station 1185+00 through 1240+00

Including Big Elk Creek Fill

Item No.	Description	Quantity	Unit	Unit Price
193	Clearing right-of-way	49.52	acre	400.00
194	Excav., common, for roadway			
	From roadway excav.	425,226.0	c.y.	0.40
	Borrow Area No. 2	86,696.0	c.y.	0.40
	Borrow Area No. 3	270,027.0	c.y.	0.40
195	Excav., rock, for roadway	489,889.0	c.y.	1.55
196	Material for highway embankment Zone 2			
	From roadway excav.	114,966.0	c.y.	0.50
	Borrow Area No. 1	392,701.0	c.y.	0.50
197	Watering	7,244.0	M. gal.	1.75
198	Rolling Embankment	4,872.0	R. hrs.	7.50
199	Overhaul	256,625.0	mi. c.y.	0.25
201	Excav., all classes, for structures	144.0	c.y.	3.00
202	Compacted backfill	2,271.0	c.y.	2.50
203	Crushed-rock under riprap	238.0	c.y.	4.50
204	Dumped riprap	87,559.0	c.y.	2.25
205	Hand-placed riprap	167.0	c.y.	20.00
210	Furn. & lay. 24" 14-gage CMP	306.0	l.f.	6.50
213	Furn. & lay. 48" 12-gage CMP	756.0	l.f.	17.50
215	Furn. & erect 84" 1-gage MP CMP	450.0	l.f.	75.00
221	Right-of-way markers	30.0	ea.	11.00
	Total			$1,717,749.55

● The newly completed relocated U. S. 26, at Big Elk Creek Fill. Photo also shows detour route.

As shown by the cross-section (Figure 3) an 84-in., 1-gauge multi-plate Armco corrugated pipe was placed at the upstream bedline on a 0.03 grade. This pipe was strutted 5 percent in excess of the nominal diameter in the vertical direction before the rest of the fill was placed. Barco gasoline powered compactors ("Leaping Lenas") were used to compact soil around the pipe as it was assembled. All fill material was compacted by the heavy Bureau No. 2 sheepsfoot rollers, giving about 1500 psi bearing pressure on feet in contact with a horizontal surface. This pressure is over 5 times greater than required in Idaho for normal highway construction jobs.

The contractor carried the Zone 1 fill higher than the Zone 2 material at all times during the construction. (Shown by accompanying picture).

The highway grade line is on a continuous 7° 45′ spiraled curve at a point 13 ft. under the grade line, midway between the ends of the fill. Seven 48-in. corrugated pipes were placed at about 10-ft. centers, parallel to each other, to carry flash flood waters from above the fill into the reservoir. The flow line of these pipes is at elevation 5617 on the upstream end and is on a 0.03 grade, making the outlet ends below the normal reservoir water level of 5620.

Hauling Payment

Overhaul on this project was calculated differently than is done on most highway jobs. Overhaul on the roadway excavation (over 800 ft. free haul) was paid for at the rate of $0.25 per yd. mile, calculated to the nearest 0.1 mile from center of gravity of cut material to the center of gravity of fill, as deposited, measured along the center line.

Haul was paid from borrow pits, there being no free haul distance for borrow excavation. The length of haul was measured along the shortest practicable route between the center of gravity of the material, as found in excavation, and the center of gravity of the material as deposited in each station to nearest 0.1 mile.

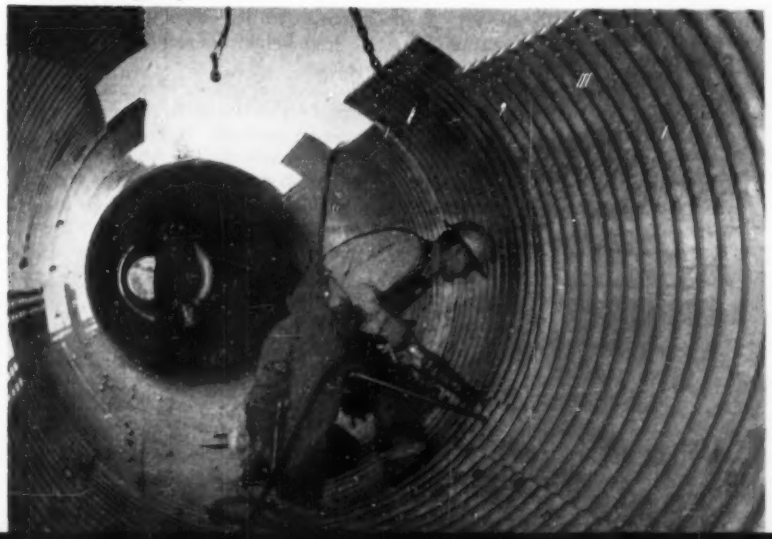
Payment quantities were calculated for Zone 1 and 2 from the mass diagram. Fills were not cross-sectioned after construction. It was the contractor's responsibility to see that the fill was built up to, and not over, the cross sectional design.

Payment for dumped riprap was made at the unit price bid per cubic yard and included the entire cost of procuring, hauling, handling, and placing the materials where required. Measurements were taken from the drawings. Rock fragments excavated from the roadway which broke too large for Zone 2 material was permitted as riprap. Otherwise this rock would have been wasted. This was a break for the contractor, as he got paid for rock excavation and riprap for the same material. While the quantity was comparatively small, he naturally took advantage of it.

The fill was carried up to 42 ft. top width, which included subbase. The selected borrow subbase was rolled with a heavy sheepstoot roller and wetted when necessary. The surface course, not in this contract, will be placed to 6 in. compacted thickness in two layers of ¾ in. minus crushed rock using spreader boxes. Sufficient soil binder will be blended in to make a compact surface course. The binder material passing the 200-mesh is not to exceed 65 per cent of the fraction passing the 40-mesh sieve; Plasticity Index 6 or less, and Liquid Limit not to exceed 35. The surfacing material will be covered with a 2-in. hot plant mix bituminous surface.

The Kiely Construction Company of Butte, Montana, was the subcontractor to Palisades Contractors, Incorporated, Palisades, Idaho, on the whole section of the road. L. B. Ackerman is construction engineer for the U. S. Bureau of Reclamation. Fred D. Miles was in charge for the Idaho Department of Highways, representing E. V. Miller, state highway engineer.

● Construction of 580′ x 84″ Armco Multi-plate drain, 40 ft. above subgrade on the big fill, will form a small lake (700 acre-feet) behind the relocated highway.



Roads and Streets in the News

Toll Roads Make More Headlines

NEW developments in toll highway financing and construction, as reported to ROADS AND STREETS, include the following:

• ARKANSAS: Revenue bond financing of a toll road between Little Rock and West Memphis will not become feasible for 10 or more years, according to a report submitted to the state highway department by the engineering firm of Brown & Blauvelt of New York and Wilbur Smith & Associates of New Haven, Conn.

The report mentioned two alternatives, both involving considerable state funds. One would require the state to guarantee any deficits which might develop during the period of indebtedness. The other would require the state to make an out-right grant of $24,000,000 toward the estimated $80,000,000 cost of the 120-mile project.

• KANSAS: After being named to the $25,000-a-year post of general manager of the Kansas Turnpike Authority, Gale Moss was authorized to seek feasibility reports for four additions to the projected 236-mile main turnpike from Kansas City, Kan., to the Oklahoma border at Wellington.

The reports will cover: a northeastern Kansas spur running from Bonner Springs to the Missouri line across the River from St. Joseph; a western Kansas spur from Wichita via Hutchinson and Great Bend to Hays; a new intercity viaduct connecting Kansas City, Kan., and Kansas City, Mo., and a new 18th St. bridge in Kansas City, Kan.

The agreements for the feasibility reports would be worked out between the turnpike authority, the highway commission and the authority's two consulting engineering firms, Coverdale and Colpitts of New York and Howard, Needles, Tammen and Bergendoff of Kansas City.

In another action, the Kansas authorized employment of Prof. Charles H. Scholer of Manhattan to obtain "factual data" on the comparative cost and merits of rigid concrete and flexible bituminous paving for the turnpike. Scholer is head of the Kansas State College department of applied mechanics and is director of the state highway department's material laboratory.

• INDIANA: Plans to market a $178,000,000 revenue bond issue about Dec. 1 to finance a north-south Indiana toll superhighway were announced by the State Toll Road Commission, which hopes to get construction started early next summer.

Commission executive director A. J. Wedeking said the projected borrowing was reduced from $225,000,000 because of a decision to cut the length of the turnpike by about 20 miles at the Indianapolis end. The currently planned route will run from Hammond southeasterly to the Indianapolis area, 131.6 miles. The new pike will tie in at Hammond with the east-west Indiana turnpike now under construction, 156 miles long, connecting with the Ohio Turnpike.

Three suits challenging the legality of the operations of the Indiana Toll Road Commission were filed in Marion County Circuit Court in Indianapolis by Ira L. Haymaker, Indianapolis attorney. One suit, brought by a motel owner, attacks the validity of a trust agreement between the commission and its banks as trustees of the $280,000,000 in bond funds for the east-west toll road. Haymaker contends the commission is spending east-west turnpike bond revenue to promote a proposed north-south toll road and thereby jeopardizing the value of the east-west turnpike bonds. He asked the court to declare the trust agreement invalid.

The suits are intended to delay the sale of bonds for a north-south toll road until the 1955 state legislature convenes and has an opportunity to restrict the powers of the commission to build additional toll highways.

• NEW YORK: Formal opening in late October of a new 183-mile stretch of the New York State Thruway between Westmoreland and Utica gave the state the longest operated toll highway in the nation. Opening of the new section doubled the amount of cross-state expressway open to toll traffic to a total of 366 miles. This is longer than the Pennsylvania Turnpike and more than triple the length of the New Jersey Turnpike.

Remainder of the 427-mile thruway is slated for completion in 1955.

Toll Financing Can Expedite Maryland Program

• MARYLAND: A report submitted to the State Legislative Council by the State Roads Commission recommended the enactment next year of Maryland legislation authorizing designation of a projected north-eastern expressway as a toll highway. The expressway would run 48 miles from Baltimore to the Pennsylvania line near Elkton. It would roughly parallel US 40.

Under the state's current 12-year highway modernization program, the expressway is not scheduled for completion until 1965. If taken out of the long-range program and built as a toll highway, it could be finished within three or four years. Any other roads designated in the future for tolls to partially finance their construction could similarly be taken out of the long-range free highway program and undertaken more quickly without waiting their turn on the present schedule, the commission pointed out. The road commission's report said that recent studies by the engineering firm of Coverdale and Colpitts indicated that the $29,526,000 cost of the projected northeastern expressway could be paid off in 16 years if a toll of about 1.38 cents a mile for passenger cars is charged. Revenue bonds, under the estimates, would be limited to 3½ per cent interest.

Chief Engineer Norman M. Pritchett of the State Roads Commission recently announced that expenditures under his program in 1954 will reach $92,000,000, of which $78,000,000 will go for construction and $14,000,000 for plans, surveys and purchase of right of way. The state's largest prior road construction year was 1949, when total spending reached $59,000,000.

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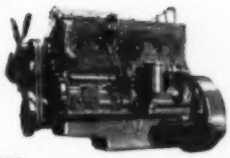

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NEW factory-installed 50-inch one-man cab that permits balanced, 2-side loading of steel, lumber, pipe and other longer-than-truck materials.

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NEW multi-stop models with METRO® bodies—14,000 to 16,000 lbs. GVW. 10 other models—5,400 to 11,000 lbs. GVW with METRO and METROETTE bodies—available with new METRO-Matic transmission.

PLUS four-wheel-drive models of 11,000 and 15,000 lbs. GVW—built for lowest cost operation in roughest, toughest terrain.

PLUS factory-installed, Underwriters approved LPG power, available as optional equipment in 54 models from 4,200 to 45,000 lbs. GVW.

PLUS 10 diesel engines for 30 models. The INTERNATIONAL line of 185 basic models offers widest choice of power—30 engines, gasoline, LPG and diesel.

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INTERNATIONAL TRUCKS

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. . . for more details circle 191, page 16

"One Kompactor is doing the work of 2 crawlers and 4 tamping rollers"

says TOM LANE, Superintendent, Huron Contracting Co., Holland, Ohio

Tom Lane is working two Buffalo-Springfield K-45 Kompactors on the Huron Contracting Co.'s 8 mile section of the new Ohio Turnpike. The job calls for 2½ million yards of grade material . . . compaction specifications call for between 98 and 102 per cent.

"With our new Kompactors these requirements are being met with unusual speed and ease. *On our job one of the K-45's is doing the work of 2 crawlers with 2 tamping rollers each in tandem,*" reports Lane. He also states, "Because the K-45 is so maneuverable there has been absolutely *no* hand tamping time on this project. It can really work in close to abutments and culverts."

Another important time saver that Lane reports on is, "The K-45 leaves a relatively *smooth finished surface* after compacting, and if we're caught by an evening shower we don't have to go back and do the job over again the next day."

Since introduction the Kompactor has been setting performance records. The "Interrupted Pressure Principle" design of the rolls on the K-45 allows all compaction effort to be *downward* . . . results in greater, more uniform density from lower elevation to top surface. The rolls are unique segmented "islands" of heavy steel pads placed in staggered positions around the rolls . . . enter loose material with minimum forward or horizontal displacement.

For better, lower cost compacting get the facts on the revolutionary Buffalo-Springfield K-45 Kompactor. See your nearest distributor or write for complete information today!

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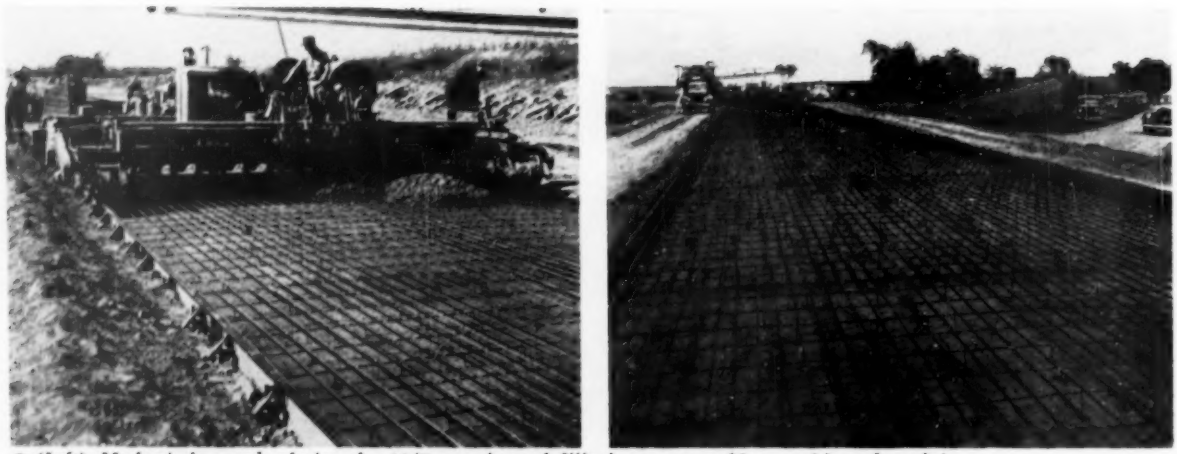


● (Left) Mechanical spreader laying the 1947 experimental Illinois pavement. Note position of steel is at midpoint of 7-in. slab. (Right) View of the longitudinal steel in place.

A Design for Continuously Reinforced Concrete Pavement

By Wayne R. Woolley

Highway Products Engineer, Truscon Division, Republic Steel Corporation

The first continuously reinforced concrete pavement was constructed near Stilesville, Indiana, as long ago as 1938. Other experimental stretches have been in use in Illinois, Texas, New Jersey and California.

Using data collected from these experimental stretches, it is now possible to design a pavement which will behave in a predictable manner. In addition, continuously reinforced concrete pavement is competitive with that of other designs of heavy-duty pavements, since the cost of the additional steel is balanced by savings in omission of joints, a somewhat thinner slab, and less expensive subbase.

These experimental stretches were designed to overcome various problems sometimes characteristic of ordinary concrete pavements, such as faulting and pumping at joints. We know from experience that if the proper amount of reinforcement is placed in concrete pavement, cracks will form about six feet apart. The continuous steel holds these cracks tightly closed preventing the entrance of either water or dirt in sufficient quantities to cause trouble. There are no joints to cause bumps, and no black lines across it caused by attempts to seal joints with asphalt. Maintenance costs are quite low and there is now reason to believe that the service life of continuously reinforced concrete will exceed that of other pavement designs by a number of years.

About the Author

Mr. Woolley, who holds a B. S. and also a professional civil engineering degree from the University of Illinois, was briefly with the Illinois Division of Highways, then served the U. S. Bureau of Public Roads for 27 years. He is the author of a number of papers on highway problems, including the subject of continuously reinforced concrete.

Experimental Pavements

Continuously reinforced concrete pavements are constructed without transverse joints and with the steel continuous. The experimental pavements, all of which were constructed on heavy-duty roads, varied from 7 to 10 in. in thickness and the area of the longitudinal steel varied from a minimum of 0.3% to a maximum of 1.82% of the cross-sectional area of the concrete. Subgrades have varied from a poor silty clay with pumping characteristics to 10 in. of granular base of which the top 4 in. was stabilized with cement. Despite wide variations, all designs have been satisfactory. Only about 50 sq. yd. of pavement failure has been reported for all these projects.

The main portion of continuously reinforced pavement is kept from moving longitudinally by friction between the concrete and the soil. Let us assume a piece of pavement 100 ft. long that is rigidly anchored at each end so it cannot move. If the temperature of the concrete should drop 70°F., which is about the maximum drop below the temperature at time of construction that is likely to occur, then a piece of concrete 100 ft. long would shorten by 0.4 in. if it were free to contract. But in our example, the pavement is not allowed to move and, as a result, the tension causes cracks. Based on experience, we know that, on the average, cracks in continuously reinforced concrete containing 0.5% steel will occur about every 6 ft. Thus, in the assumed 100 ft. of pavement, there will be about 16 cracks. The 0.4 in. pavement contraction will be divided among 16 cracks and each theoretically will open 1/16 of 0.4 in., or .025 in. Measurement of crack widths shows that they actually open somewhat less than this.

Thus, we have a pavement with an average distance between cracks of

6 ft. a maximum crack width of .025 in., and all held firmly together by two or more times as much steel as is placed in standard pavements. The heavy steel and tightly closed cracks cause loads to be perfectly shared by adjacent slabs, thereby avoiding excessive stresses in the concrete and subgrade such as occur in jointed pavements where loads are concentrated on one side of the joint.

During summer heat, the compressive stress in the concrete is sufficient to shorten the pavement by the amount the temperature rise would tend to make it lengthen. This stress, while it has not actually been measured, has been variously calculated to be from 1500 to 2500 psi., but there are reasons to believe that this stress is not as high as these estimates.

Steel stress in normally reinforced concrete pavement has not been determined, but judging from crack widths and the fact that instances of broken steel are not rare, it appears that the steel is often stressed beyond its elastic limit. This is considered acceptable design for a structure such as concrete pavement in which a steel failure causes no disaster, but merely allows the pavement at the location of the failure to behave as though no steel had been installed originally.

Steel Behavior Data

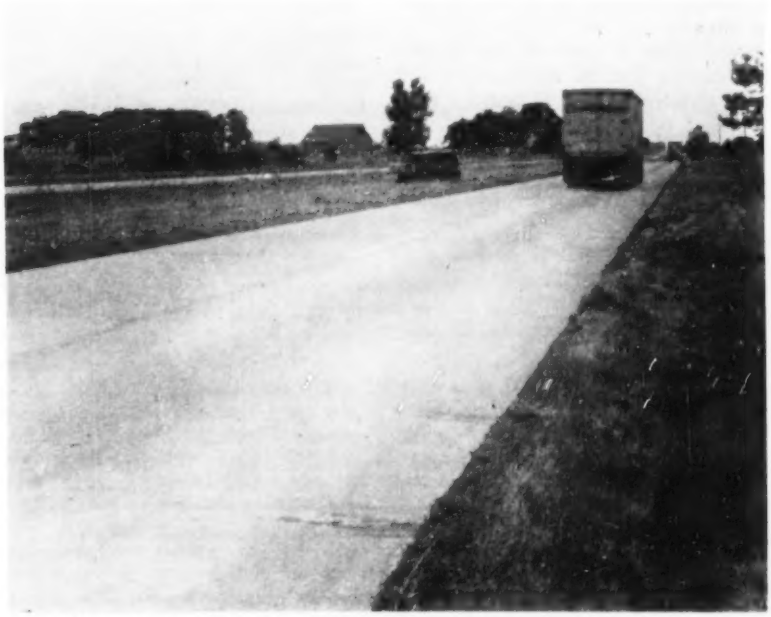
On the basis of inconclusive data, it appears that less than 0.7% steel in the experimental pavements may be stressed beyond its elastic limit during the first winter. In spite of this indication, no steel failure on any projects has been reported, not even on the 0.3% steel section. The theoretical explanation for this apparent discrepancy is not known. The explanation may be that once closely-spaced cracks have formed, there is no desire for cracks to open more than about .025 in., and this is not enough to rupture the steel. Although the 0.3% steel did not break, it is felt that this amount of steel provides virtually no factor of safety.

● Closeup view of the concrete used on the Illinois pavement. Note size of coarse aggregate.

The evidence indicates that any amount of steel which is capable of forming transverse cracks in the pavement at spacings of 10 ft. or less will be adequate to prevent failure. A percentage of 0.4 is believed adequate, particularly if tension in the concrete and steel is prevented after the first winter by means to be described later.

Theoretical considerations indicate an advantage for high strength steel. There is no conclusive experience on record to verify this theoretical consideration.

On the other hand, there is evidence that the use of more steel than required is detrimental. The data consistently show that the larger the percentage of steel, the closer together are the transverse cracks. Observation indicates that cracks spaced closer than 3 ft. result in excessive deflection under live loads and this deflection introduces unnecessarily large stresses in the concrete and in the underlying subgrade.

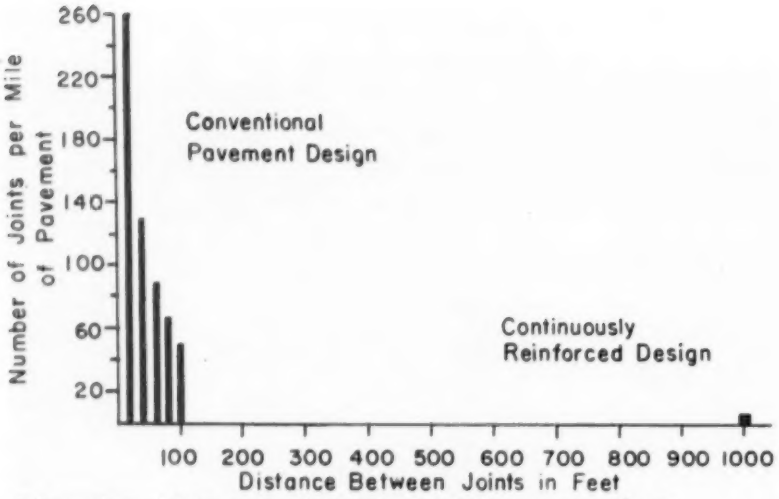


● Condition of Indiana's experimental pavement on U. S. 40 near Stilesville, Ind., after 16 years service.

JOINT DESIGN

On all experimental projects to date, construction joints at the end of a day's work were placed with bonded steel continuous through the joints. In a few instances, cracks developed adjacent to the joint on the next day's pour at spacings considered too close for maximum load carrying capacity.

Perhaps some change of design at construction joints is desirable. One method would be to construct contraction joints with slip dowel load transfer at the end of each day's work.



● Comparison of joint spacing between conventional pavement and continuously reinforced pavement.

Such a joint would be expected to open a maximum of 1½ inches during the first winter and lesser amounts each succeeding winter until, after three or four years, it would not open at all.

Presumably, under these conditions, the transverse cracks become more numerous and tend to open a little wider with the passage of time until the expansion space at slab ends becomes permanently closed. Although a joint opening of 1½ in. is no more than that of many expansion joints in standard pavement, such an opening is likely to be more or less objectionable.

Possibly the objectionable features of a joint installed at the end of a day's run could be overcome by thoroughly cleaning the open space and filling, with sand-cement mortar during the first winter when the concrete temperature is about 40°F. In all probability, joints so treated would never open again and no maintenance would be required. The pavement would have the characteristics of prestressed concrete as it would be in compression most, and perhaps all, of the time. Crack widths would be kept at a minimum and tensile stresses would either be small or non-existent.

Filling joints with concrete during the first winter would merely arrest further opening of cracks with no effect on the ultimate maximum compression in the concrete. No evidence of distress due to compression caused by high temperature has been reported on any continuously reinforced pavement.

It is conceivable, of course, that very finely divided material may sift into even tightly closed cracks. If this does happen, it appears that the elasticity of the concrete is sufficient to absorb any non-uniform compression which may develop. As a final thought the presence of heavier than normal steel reinforcement would be expected to provide additional strength against buckling due to compression.

PAVEMENT THICKNESS

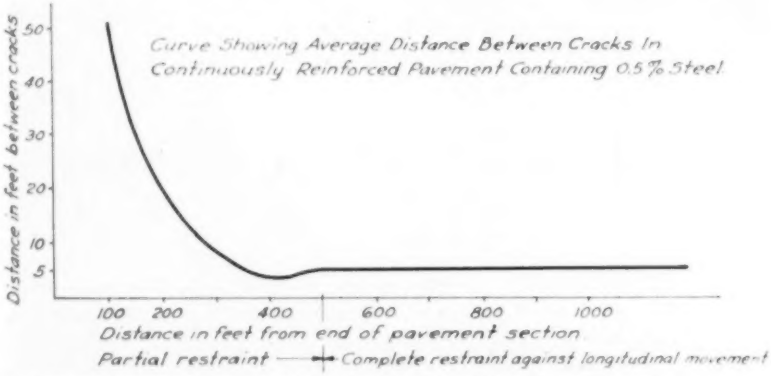
Modern heavy-duty concrete pavements are normally constructed 9 or 10 inches thick with less than half as much reinforcement as is recommended for a continuously reinforced pavement. A thickness of this amount is necessary to prevent corner breaks and excessive cracking which may lead to failure. The critical stresses in normal jointed pavements occur at corners and free edges such as joints. These stresses are the result of warping and of the inability of load transfer devices to transfer the required percentage of live loads across open joints. The reinforcing steel in normally reinforced concrete pavement aids in holding cracks tightly closed and in transferring loads from one slab to the adjacent one. Also, steel in normally reinforced pavement is designed only to resist tension due to subgrade friction. No additional steel is provided for bending stresses under loads.

It seems obvious that in a continuously reinforced pavement containing at least twice as much steel, more effective resistance to bending and better transfer of loads across cracks will be obtained. There will be virtually no warping stresses because of the close spacing of transverse cracks which relieve these stresses. The weak areas caused by joints will be considerably less in continuously reinforced pavement, since there are only 2% to 10% of the number of joints commonly placed in pavements of other designs.

Filling joints with concrete during the first winter will not only strengthen the pavement at the joint, but also strengthen the entire pavement by eliminating tensile stresses. Because of all these factors, it is considered good design to construct a continuously reinforced pavement somewhat thinner than is permissible for standard pavement.

A pavement 6 in. thick would probably give satisfactory service; however, it might crack longitudinally under very heavy wheel loads since in continuously reinforced pavement the greatest dimension of slab is likely to be the width. The acceptable design thickness in such a pavement appears to be controlled by that thickness which would prevent longitudinal cracking for the width of lane constructed. A thickness of 7 in. is believed adequate for moderately heavy-traffic roads. This thickness has been adequate in both Illinois and Indiana. For heaviest traffic highways, a more conservative thickness would be 8 in.

There appears to be no reason for constructing any continuously reinforced pavement thicker than 8 in.



● Average distance between cracks in continuously reinforced pavement containing 0.5% steel.

as the pavements will be designed to prevent longitudinal cracking, transverse reinforcing is needed only to properly position the longitudinal steel.

SUBBASE REQUIREMENTS

The experimental pavements in Indiana and Illinois were constructed directly on a silty clay soil known to be susceptible to pumping. In fact, pumping began at the open joints on both projects soon after opening to traffic. As previously mentioned, pumping occurred at only one place on the Indiana project which was not adjacent to a joint. It is believed that this small area of pumping could have been prevented by good maintenance of the shoulder or by a pavement design which would have avoided transverse cracks closer than 3 ft. apart. Even after the pumping had been in progress for some time, under-sealing the pavement would most likely have stopped any further trouble.

According to the latest reports, after pumping had been in progress at this area for five years, the concrete had apparently shattered and had been patched with bituminous material for an area of about 4 sq. yds.

● Size of typical crack in the continuously reinforced pavement section of U. S. 40 containing 0.45% longitudinal steel.

The soil underlying the Illinois experimental pavement is also silty clay with pumping characteristics. On this project no pumping has occurred except at expansion joints between experimental sections and at a few construction joints. As previously mentioned, it is recognized that an improvement in the design of construction joints is desirable and a method of correcting this has been suggested.

Granular subbase, generally 6 in. thick, has been placed under many miles of concrete pavement in order to prevent pumping. The experiences in Indiana and Illinois show that pumping has been almost entirely absent on continuously reinforced pavement sections although built on poor soils and subject to heavy truck traffic.

It is believed that pumping can be entirely avoided on future continuously reinforced pavements by the design changes outlined herein and by reasonable shoulder maintenance. For those areas where granular materials are plentiful and economical, a granular subbase, but not more than 3 in., might be considered for roads carrying exceptionally heavy truck traffic.

The use of a subbase thicker than 3 in. can be justified only where subsurface water or differential frost heaving are problems.

ADVANTAGES OF DESIGN

Continuously reinforced concrete pavement eliminates most of the joints necessary in normally designed pavement. Joints are areas of weakness in normal pavements, often responsible for rough pavement, broken concrete, and high maintenance costs. By the method of joint design suggested, the few joints installed in continuously reinforced pavement can be strengthened and at the same time the advantages of prestressed concrete can be obtained at a nominal cost.

The first cost of a continuously reinforced pavement will generally be less than that of ordinary heavy-duty pavement, the maintenance cost lower, and the anticipated useful life greater. In this connection, one example is cited, the normal reinforced and jointed pavement in Indiana which adjoins the continuously reinforced section. Both sections were built the same year and carry the same traffic. The normal jointed section was resurfaced in 1952, whereas the continuously reinforced section is still in very good condition (see photo).

Summary of advantages of continuously reinforced concrete pavement:

1. Elimination of joints and open cracks.
2. Riding qualities approximately the same throughout the pavement life.
3. Longer life and less maintenance cost than non-reinforced concrete pavement.
4. Apparently a longer useful life than standard reinforced concrete pavement.
5. First cost comparable with that of standard reinforced concrete pavement.

● Average speeds on the Texas highway system during 1954 are reported at 55.7 mph for passenger cars, down 1.2 miles from the survey made a year previous. Truck speeds are down 1.8 mph, bus speeds 2.4 mph.

Summary of Design Recommendations for Continuously Reinforced Concrete Pavement

Amount of longitudinal steel:	0.4% to 0.5% of cross-section of pavement, the exact amount depending on factor of safety desired.
Amount of transverse steel:	Minimum amount necessary to properly position longitudinal steel.
Type and location of steel:	Deformed bars — No. 4, 5, or 6 longitudinal and No. 3 transverse — placed halfway between top and bottom of slab.
Tranverse joints:	Contraction joints with load transfer to be installed only at end of each day's work. These joints to be filled with concrete during the first winter.
Pavement thickness:	7 to 8 in. depending on weight of traffic loads.
Subbase requirements:	Ordinary soil in place except that up to 3 in. of granular subbase may be justified under certain conditions.

Amount of longitudinal steel for various alternate designs. Tranverse steel as required to be in addition to steel listed.

Pavement Thickness (inches)	*Percent Longitudinal Steel*	*Size Longitudinal Bar*	*No. Bars with Spacing per 12 Ft. Width*	*Wt. Longitudinal Steel (lb. per 100 sq. ft.)*
7	0.4	No. 4	20 @ 7 in.	112
7	0.4	No. 5	13 @ 11 in.	113
7	0.5	No. 5	16 @ 8½ in.	139
7	0.5	No. 6	11 @ 13 in.	138
8	0.4	No. 5	15 @ 9½ in.	130
8	0.5	No. 5	19 @ 7½ in.	165
8	0.5	No. 6	13 @ 11 in.	163

EDITORIAL

"Let Us Be Ready, Let Us Have Vision,

by Harold J. McKeever

AS THIS is written, the Clay Committee is about to make its report to President Eisenhower on what the country should do about its highways.

Whatever the Committee's specific recommendations, we are sure to see dramatic congressional action on road financing in 1955. The 44 state legislatures that meet in 1955 also will consider hundreds of bills to provide more road funds and better administrative machinery. The American people are in a roadbuilding mood and highway administrators are faced with planning for a rapid doubling of the construction program, which is now paced at about $3.7 billion a year.

This is indeed action time, and "Action!" was the stirring theme at Seattle, where the American Association of State Highway Officials met in November to consider the big job ahead. No more inspiring words could have been voiced than those of E. A. Johnson in his presidential address at Seattle:

> **"Let us be ready, let us have vision, let us do the job with distinction and honor, let us be equal to the task, and above all let us design and build adequately for the future.**
>
> **"Think big, have confidence, and start your planning for this program from this very moment."**

• Let us examine some of the kinds of action which highway leaders must undertake.

First is to get on with the job of measuring the need for better highways. The Bureau of Public Roads has just completed a study of deficiencies on the interstate system. Fortunately many states have completed studies of their road, street and bridge conditions, and other states have set such surveys in motion. States which have not begun a need study should do so at once.

The study must be comprehensive, objective, and sponsored by organizations which have the confidence of the legislature and the public. A financial study and legislative program for the states can then follow on a sound basis.

Advance planning comes next — so that a priority of projects can be set up in the public interest and the orderly procedures of fund allocation, right of way acquisition, surveying, plans preparation, and construction can be carried out efficiently. Not all states in the recent past have been on their toes in advance planning and programming. During the war years some states were severely penalized, for this reason, by having to put off road jobs while the public suffered and inflation upped the eventual cost. More such penalties threaten.

• Right-of-way acquisition looms as a serious bottleneck of advance work. It will be a big and important part of the job of revamping the interstate system to new location. Better laws are needed in nearly every state to permit rapid land acquisition in the maximum public interest and with justice to individual property owners. The Texas philosophy of getting right-of-way far ahead of programming is worthy of study here.

Research must be stepped up all along the line, and a fresh exploratory attitude adopted to help evolve better road designs, materials and construction methods. President Johnson at the Seattle AASHO meeting reminded us of "a strong and uncompromising need for activity in the fields of economic and physical research, driver conduct, traffic management, need studies, evaluation of existing facilities, and revenue studies."

The recent review of the Bureau's research by a task committee, new research plans of the Highway Research Board, studies by the Bureau in chemical stabilization, the decision to get on with the Illinois test road — these are signs of a new spirit of inquiry. It is hoped that any new federal legislation will follow the pattern set by the Federal Highway Act of 1954 and provide liberally and broadly for research. Money is not the chief need, however, but new ideas, fresh viewpoints, and better administrative methods of putting newfound facts to work.

A greatly enlarged road program will require much larger and more highly geared roadbuilding agencies. The state highway departments are particularly in the spotlight, since they will undoubtedly carry the ball. Every department not already revamped to a modern form should be changed

Let Us Be Equal To The Task Ahead"

over at once, and the necessary legislation enacted to make this possible. Some states still have horse-and-buggy road organizations, hampered by politics and lacking in proper departmentalization and clear lines of internal authority.

• Finally, the biggest problem of all facing highway departments is to measure up to the job. This means leadership at the top, and full staffing with competent career people. Some progress has been made in winning better pay scales and career inducements, but nearly every state highway department today has jobs going begging as young engineers (and old) turn to other fields for better incomes.

Industry would hire $100,000 executives to run a hundred-million-dollar-a-year operation such as a modern highway department. If we are to invest new billions in roads in the full public interest, young engineers should be recruited with the chance to compete on merit for eventual top posts paying in many cases $20,000 and up, with better pay scales along the way.

Meanwhile, new effort must be made to stretch out the engineers we have, by giving them better technical support, making better use of labor-saving techniques such as aerial surveying, and tightening up the ship generally. Meanwhile contractor associations and highway departments working together can do much more than they have done to step up the procurement and training of young engineers.

One final word — about our contractors and equipment and material suppliers. Can they handle a king-size road program? Recent surveys by ARBA, AGC, CIMA and others show that, barring another war, this will be no problem at all. And in taking the task in stride, our industry will make a major contribution to prosperity and the country's future.

Why Eisenhower's $50 Billion Road Proposal May Turn Into a $100 Billion Job

The Plan: to invest more than $100 billion in the nation's highways and streets in the decade of 1955-64.

Plan Would Involve: Virtually complete reconstruction of the 40,000-mile interstate system — the 1¼% of the roads which carry 20% to 25% of all rural road traffic; thousands of miles to expressway standards, requiring many bridges and grade separations.

Widening and straightening of arteries through and around cities.

Concentration of the over-all road building job on main arterials to a new degree, while resulting also in more construction on state, county and local roads and local city streets.

Total Cost of Job: Present road and street building rate, $3.7 billion annually at all government levels (plus 2.8 billion for maintenance and other costs). Natural growth in user tax revenues would yield $46.8 billion for construction under present set-up.

To take care of traffic growth from a present 58.4 million to a predicted 81 million registered vehicles by 1965, another estimated $54.5 billion will be needed. Total: $101 billion, as headlined in October.

Where Money Might Come From: Under one proposal, federal share would be $25 billion or more, or at $2.5 billion annual rate, about equal to the present revenue from federal gasoline tax and excise tax on automotive products, as compared to $875 million annually under present highway act. Most of sum would go to interstate roads, rest for normal federal aid on matching basis.

States' share to come from present sources plus bonds and possible federal loans.

Idea being studied of creating a corporation owned by the federal and state governments, which could borrow road funds not reportable in the regular federal treasury budget.

Toll Roads: Are expected to take care of $10 to $13 billion of construction in the decade. $5.6 billion of toll projects are now approved but not begun, totaling 4,700 miles, and another 5,200 miles more are planned, in addition to those under construction. Thus the combined federal and toll road part would be $35 to $38 billion for the decade, leaving $63 to $66 billion to come from states, cities, county, local, etc.

Profit to Public: Through saving of $30 billion or more for the decade that otherwise would be lost under present conditions due to wasted gasoline, excessive tire, brake and repair cost, economic cost of needless traffic accidents, lost time to commerce and industry.

Remainder of program cost to be repaid to the public in stimulated growth to commerce and industry, higher living standard, more adequate national defense.

OHIO TURNPIKE. Max Julian, Angola, Indiana, holder of a 1,000,000-cubic yard earthmoving sub-contract, rates INTERNATIONALS this way: *"My TD-24 powered scrapers can't be beat for production and my 2T-75 high-speed earthmovers are faster, sturdier and haul more weighed yards per trip than any others with the same capacity."*

MAINE TURNPIKE EXTENSION. DeMatteo Construction Co., Quincy, Mass., team these three INTERNATIONAL Model 2T-75s with 8 TD-24s with dozers and scrapers to move 1,250,000 cu. yds. of borrow on 9.145-mile Turnpike contract.

WEST VIRGINIA TURNPIKE. Bates and Rogers Construction Corp., Chicago, find the INTERNATIONAL TD-18A crawler and 3 cu. yd. INTERNATIONAL DROTT Skid-Shovel a great all-around performer in constructing ½-mile tunnel between Standard and Fairfield, W. Va.

WEST VIRGINIA TURNPIKE, Morrison-Knudsen Co., Inc. and R. E. Mills Company, Cabin Creek, West Virginia, used INTERNATIONAL TD-24 to push-load scrapers on a 9-mile contract on the recently opened West Virginia Turnpike.

NEW HAMPSHIRE TURNPIKE. Leveling fill on the New Hampshire Turnpike is a fast moving job with an INTERNATIONAL TD-24 and bulldozer supplying the power. R. G. Watkins & Sons, Inc., Amesbury, Mass., equipment owner.

IH works on the Superhighways

From pioneering to paving, INTERNATIONAL equipment speeds the nationwide superhighway projects with lower costs and greater contractor profit.

Contractors who build super roads buy INTERNATIONAL equipment for the same reason the general public snaps up Turnpike bonds—IH is a shrewd, safe investment netting top returns.

There's one common characteristic about all INTERNATIONAL earthmoving equipment—it is designed to move more paydirt for less money from start to finish on every job. Best thing is that these operating advantages are available to all contractors—fleet owners and owners of a single tractor, alike.

Call your INTERNATIONAL Industrial Power Distributor today for full details or an on-your-job demonstration of the IH equipment needed in your operations. You'll be money ahead this year and in the years to come. Besides, you can always depend on prompt, efficient service and genuine replacement parts for your INTERNATIONALS. Wherever your job may be, an INTERNATIONAL Industrial Power Distributor is nearby to serve you on the job, in his completely equipped shop.

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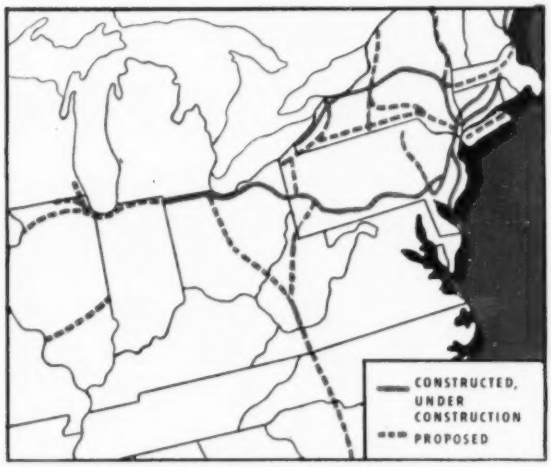

This map shows our growing network of toll roads in the eastern section of the nation with completed projects and those under construction shown in solid lines, and proposed turnpikes appearing in dotted lines.

INTERNATIONAL HARVESTER

INTERNATIONAL INDUSTRIAL POWER

MAKES EVERY LOAD A PAYLOAD

MAINE TURNPIKE EXTENSION. Here are five of the eight INTERNATIONAL TD-24s used by Nello L. Teer Company, Durham, North Carolina, shown loading out the fill on one of the firm's prime contracts totaling 13.48 miles on the Maine Turnpike Extension.

NEW YORK THRUWAY. D.W. Winkelman Company, Inc., Syracuse, N. Y., uses INTERNATIONAL TD-24 to pull elevating loader that keeps eight haul trucks rolling with 400 cubic yards of fill hourly on New York Thruway approach roads.

PENNSYLVANIA TURNPIKE EXTENSION. J. D. Morrissey, Inc., Philadelphia, uses seven INTERNATIONAL TD-24s, two INTERNATIONAL TD-18As on $5,385,313 prime contract for 7½ miles of the Delaware River extension of the Pennsylvania Turnpike.

Urban Expressway Progress

FIRST OF A SERIES

● Why Los Angeles is nation's leader in urban expressway advancement. Looking southerly along Harbor Freeway. Downtown Los Angeles at left in middle distance; 4-level interchange in foreground; Harbor Freeway extending into distance; Hollywood Freeway across picture.

. . . Los Angeles

THE Los Angeles metropolitan area today is being served by expressway segments which represent a great deal of progress since the war — with far to go. At the beginning of 1954, there were 133.4 miles of Freeways open to traffic in state highway district VII serving the metropolitan Los Angeles area. These high-capacity limited-access facilities had cost $104 million for construction. Another 40.2 miles of links representing $46 million in construction and over $108 million for right of way were under construction. These sums plus the $64 million available for the 1954-1955 fiscal year bring to $322 million the investment in our metropolitan freeways. The tabulation gives a glimpse of this tangible progress, which is beginning to bring important traffic relief to the sprawling Los Angeles region.

The freeway program, of course, has many ramifications with respect to financing and design. The following points, however, can be highlighted in this brief summary:

- The freeways are financed without bonds, under California's pay-as-you-go basis. A serious start was initiated by the Burns-Collier Act, which in 1947 increased the state gasoline tax to 4½ cents and made major funds available for freeways. The 1952 legislature first earmarked funds for advance acquisition of rights of way on freeway routes. The 1953 legislature further increased the gasoline and other taxes for a two-year period and set up a $30 million revolving right-of-way fund, greatly accelerating the freeway job.
- Freeway construction follows a long-range plan whose development was begun before the war.
- All freeways lying within the metropolitan Los Angeles area are designed on a full freeway basis, i.e., complete elimination of cross traffic and elimination of access except by interchanges and ramps. In rural and semi-rural areas the freeways have definitely controlled access.
- Enlightened right-of-way laws have made it possible to initiate over-all community planning in cooperation with local city and county agencies.
- Extensive studies have begun to bring out significant new data on the traffic and economic benefits of freeways and the adjustment in traffic flow that follows their completion.

Status of California District VII Freeway Projects

As of September 1, 1954	COMPLETED PROJECTS			UNDER CONTRACT			
	Total Miles	Miles	Construction Costs	Miles	Construction Costs	Right-of-Way Costs	Total Costs
Hollywood Freeway; Spring Street to Vineland Avenue	10.0	10.0	$ 28,640,400		$ 68,300	$ 23,977,000	$ 52,685,700
Santa Ana FW; Spring St. (LA) to Browning Avenue	35.0	28.3	32,121,200	6.7	9,451,400	13,458,000	55,030,600
Arroyo Seco FW; Four-level struct. to Glenarm St. (Pas.)	8.0	8.0	9,336,200		48,900	1,009,100	10,394,200
Ramona FW; Junc. w/Santa Ana FW; Claremont at SBdo. Co. Line	31.4	9.8	14,655,550	6.3	13,948,500	13,464,000	42,068,050
Harbor Freeway; Hollywood Freeway to San Pedro	22.8	1.7	9,093,550	7.0	10,059,235	39,032,000	58,184,785
Ridge Route; Tunnel Station to Kern County Line	45.2	45.2	11,940,100			1,975,200	13,915,300
Golden State Freeway; Olympic Freeway to Tunnel Station	29.8			3.0	3,845,500	3,293,000	7,138,500
Ventura FW; Vineland Ave. to Santa Barbara Co. Line	61.0	28.6	7,483,000	12.9	4,858,700	6,914,000	19,255,700
Santa Ana Canyon FW; Newport Beach to Riverside Co. Line	26.0	12.9	3,078,000			1,179,000	4,257,000
Sepulveda Freeway; San Fernando Reservoir to El Toro	72.5			0.4	794,924	6,242,000	7,036,924
Allesandro FW; L. A. River to Ave. 36 nr. Eagle Rock Blvd.	1.2					2,372,600	2,372,600
Colorado Freeway; Patrician Way to Kensington Place	1.4	0.4	4,978,600	1.0	1,034,500	1,991,000	8,004,100
Long Beach FW; Pacific Coast Highway to Huntington Drive	21.8	2.8	2,645,400	6.7	1,047,854	13,184,000	16,877,254
Foothill Freeway; Hampton Road To Montana Street	1.8			1.8	1,844,100	492,700	2,336,800
TOTALS	*367.9*	*147.7*	*$123,972,000*	*45.8*	*$47,001,913*	*$128,583,600*	*$299,557,513*

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Write today for information on this time-saving, cost-cutting unit for road widening and fill work. An actual demonstration can be arranged on your job.

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One man with a torch can remove a small wheel, gear, pulley or bearing—even throw away the pieces—in perhaps an hour.

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One man in minutes, with little effort, can remove, repair and install the same parts without damage to parts or tools. OTC Hydraulic Pullers are available in 17½, 30, 50 and 100 Ton sizes—may be used as detachable units or on OTC presses. Use them to push, pull, bend or spread . . . to pull and install bearings, sleeves, outer races, gears, pulleys, sheaves, shafts, wheels—anything that can be pulled.

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. . . for more details circle 200, page 16

Court Decisions That Affect Jobs

Contractor's liability in municipal construction

By Albert Woodruff Gray

A sewage ditch 8 ft. wide and 24 ft. deep was dug by a city contractor near an Oklahoma City building. Steel sheeting driven by heavy machinery was employed in the excavating. The owners of the building sued the contractors contending that the building had been damaged by the vibrations from the driving of this sheeting.

A decision absolving the contractors of this liability was affirmed by the Supreme Court of that state last June. The court rested this determination on the authority of two decisions by courts of other states, commenting in doing so that no Oklahoma decision could be found determining whether a contractor employed by a municipality with the right of eminent domain was liable to an owner whose property was taken or damaged.

One of these decisions by an Arkansas court rendered in a controversy of this character was in part, "In condemnation proceedings contractors are exempt from liability on account of damages growing out of the appropriation of lands for public purposes except for injury resulting to the landowner on account of negligence or unskilfull work."

The other authority was a decision by an Iowa court that, "It was the duty of the city to provide plans and the contractor did not assume any responsibility for defects or insufficiency of plans. The contractor would be liable ordinarily only for negligence in the performance of the work contracted for and not for the result of the work performed according to the contract."

Daly v. Earl W. Baker & Co., 271 Pac. 2d 1114, Oklahoma, June 15, 1954.

● The New Hampshire Supreme Court, on September 8, 1954, ruled that a contractor could assign all payments for work on a construction project to the surety on its performance bond. The Court held that the surety's assignment took precedence over the contractor's subsequent assignment of such payment to his bank as collateral for loans made to prosecute the work.

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Over 300 models and sizes of over 70 construction equipment and material handling products made by the Pettibone Companies are shown in this 44-page booklet. It's free!

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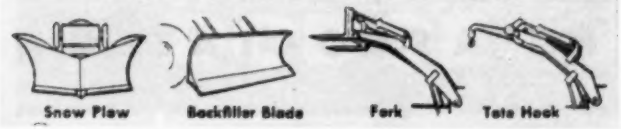

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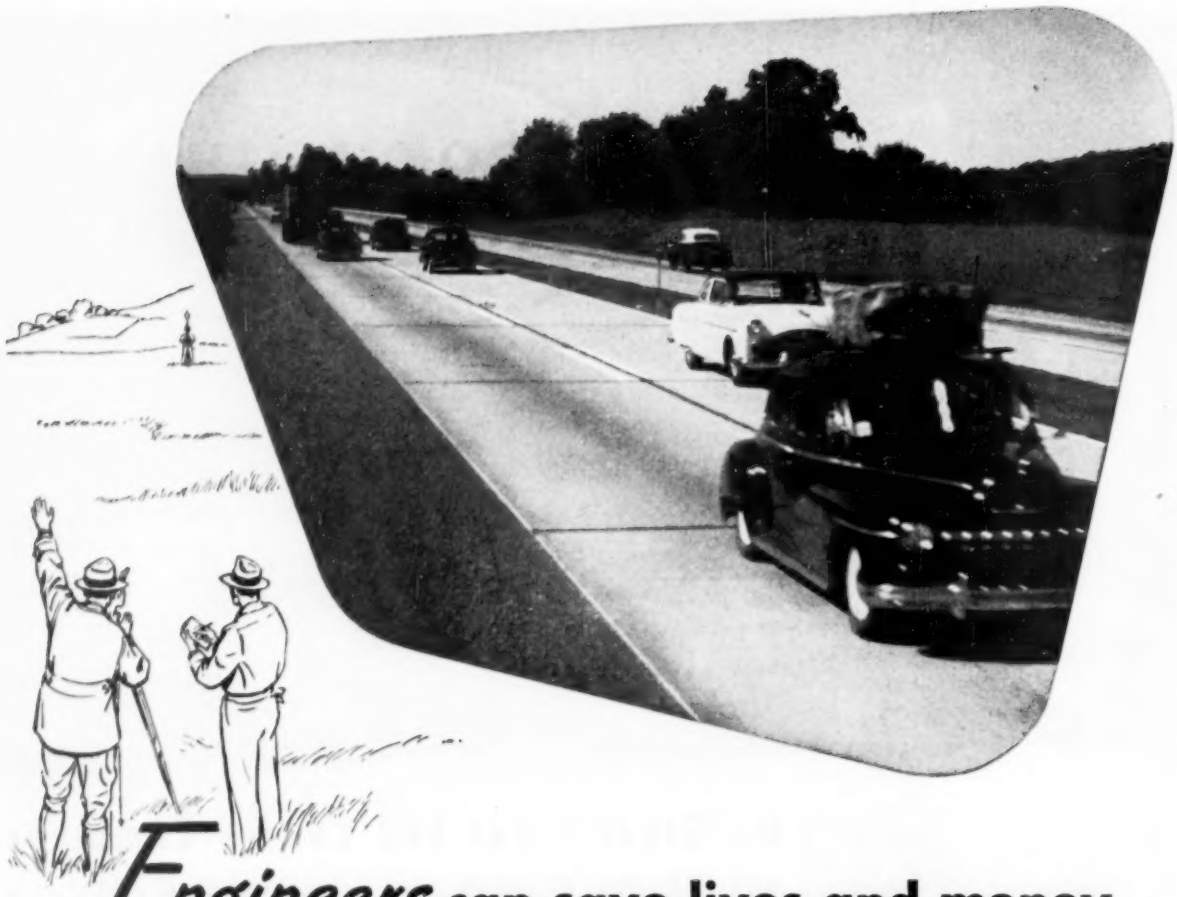

Engineers can save lives and money by building main roads of Concrete

Everyone has a vital stake in America's main roads. Everything he eats, wears or uses comes wholly or partly over highways. His welfare and the nation's defense depends on an adequate system of main roads.

Most main roads are concrete.

Ninety-two per cent of the most heavily-traveled road sections in the U. S. is concrete. Some of this pavement has been resurfaced but it is the rigid concrete slab that still carries the load.

Nearly 80 per cent of the mileage on turnpikes and toll roads in America is concrete.

Main roads should be built of concrete. It is the safest, most economical pavement.

Concrete's light color reflects up to four times more light than dark pavement. You get maximum visibility at night. *If you can't see you can't be safe!*

Concrete's gritty surface texture is protection against dangerous skidding, even in wet weather.

Concrete is free from hazardous ruts, washboard ripples and raveled edges.

All these safety features of concrete pavement help reduce the tragic toll of highway accidents.

Concrete is moderate in first cost yet can be designed accurately for any axle load—and will *keep* that load-carrying capacity throughout its life.

Concrete has the lowest maintenance cost, according to official state highway department records.

Concrete lasts longer. Today engineers know how to build concrete roads to last 50 to 100 years.

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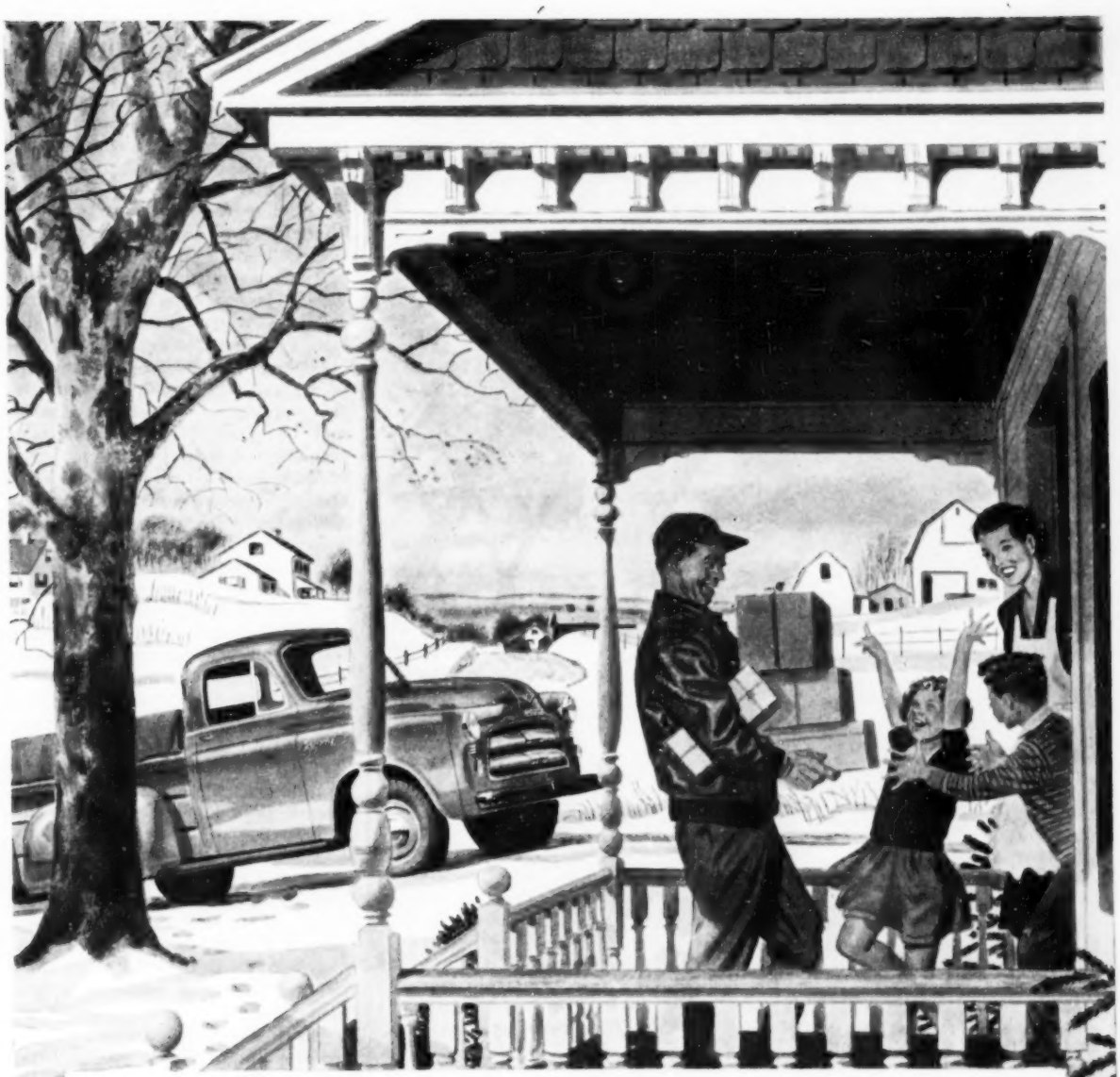
A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

. . . for more details circle 203, page 16



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AED expects big convention turn-out at Chicago

Chicago's Conrad Hilton Hotel will be the site of the 36th annual meeting of Associated Equipment Distributors from January 23-27, 1955. More than 2,000 construction equipment distributors from all parts of the United States and Canada are expected.

The convention will take over the world's largest hotel — the Conrad Hilton — where participants will discuss up-to-date concepts of distributor operation and will review developments and progress in the construction equipment industry. Attention will be given to advertising, sales planning and industry relations.

Guest speakers will address the machinery men on issues important to the industry as well as on general subjects.

AED's recently-formed "Industry Round Table" — where manufacturers and distributors discuss mutual problems — will show delegates how the group is working toward increased harmony within the industry.

The "Meet Your Manufacturer" session will be expanded, with greater facilities for conferences between individual distributors and top manufacturer executives, to be held the afternoon prior to the convention's formal opening.

At this meeting, for the first time, manufacturers will participate in business sessions in order to enhance the value of these meetings to both groups. The five-day program also allows time for distributors to schedule informal afternoon conferences with manufacturers.

Distributor sales managers will derive important benefits from two special reports being prepared for the convention: Booz, Allen & Hamilton will present a sales planning program based on comprehensive field surveys conducted for the association during the year, and a report covering manufacturer and distributor selling practices, which will be presented by Conover-Mast, trade publishers, in cooperation with AED.

AED's General Advertising Committee will join forces with a group of manufacturers' advertising managers to lead a number of discussions on distributor advertising. Topics will be tailored to the needs of advertising men in distributor organizations, and will include such subjects as direct mail, cooperative advertising, copywriting, layout and art work. Distributors and their advertising managers will be free to attend as many of these interrelated conferences as they choose.

Highway Officials Look to Big Job Ahead

ROADS AND STREETS STAFF REPORT

AASHO leaders endorse Eisenhower's highway proposal in broad principle but leave financing ideas to the President. New major research and step-up of advance planning urged at Seattle convention.

MEETING in Seattle on the eve of the pending Clay Committee report on the President's highway program, highway leaders sounded a call to action. The occasion was the 40th annual convention of the American Association of State Highway Officials, held November 9-11. The meeting was attended by several hundred administrators from the state and territorial departments and the Bureau of Public Roads.

Top news was the endorsement by the Association of the President's proposal for a greatly enlarged road program. While financing was left up to the President, the Association pledged full cooperation in compiling data. In a stirring address, retiring president A. E. Johnson, of Arkansas, spoke these words:

"The President presents a challenge that must be met. Without doubt the opportunity we have been awaiting is upon us. Let us be ready, let us have vision, let us be equal to the task, let us do the job with distinction and honor, and above all let us design and build adequately for the future."

The future he spoke of is one which will see the present 58.4 million motor vehicle registration in the U. S. swell to probably 80 million well within the lifetime of roads being built today.

"Think big, have confidence, and start planning for this program from this moment," was Johnson's concluding remark on the job ahead. He noted that AASHO has emerged as the world's acknowledged leader in specifications on highway materials, bridges and construction methods and on design geometrics.

Johnson also noted that while U. S. highway engineers are modest fellows who tend to "hide their light under a bushel," they include the best minds in the field and should assume their rightful place as experts.

Urging stepped up research, president Johnson said, "There is a strong, uncompromising need for initiating increased activity in the fields of economic and physical research, driver conduct, traffic management and revenue studies. Particularly highway officials have an unavoidable obligation in traffic safety." The AASHO administrative committee voted to go ahead with the $11.5 million six-mile test road in Illinois with federal and industry participation.

Johnson pleaded for more effort to attract young engineers and technicians into highway work. The engineer problem was also discussed at the joint AASHO-Associated General Contractor committee meeting, where it was felt that the highway departments should review job classifications to make greater use of technicians, and also take steps to insure better utilization of available manpower by such labor-saving techniques as aerial surveying.

Du Pont, Hale Shift Jobs

A surprise at Seattle was the announcement that Commissioner of Public Roads Francis V. du Pont will retire after January 1 to become special assistant to Secretary of Commerce Weeks. His task will be to advise on the President's new highway program and help advise Congress in enacting the legislation involved. Du Pont is expected to be succeeded by C. D. Curtiss, a Bureau veteran and recently deputy commissioner.

Another surprise was the news that Hal H. Hale, long executive secretary of the Association, is resigning. He will become assistant to the president of the Association of American Railroads. In his farewell remarks Hale urged everyone never to forget the Association's principal asset, which is its reputation for integrity and honesty in its dealings with the public and with Congress.

Indicating that high interest in forthcoming national legislation on roads, a full complement of congressional leaders was present to give views on the road problem. Speakers scheduled at the general session included Edward Martin (Pa.), chairman, Senate Committee on Public Works; Francis Case (S. Dak.), chairman, Senate subcommittee on roads; George A. Dondero (Mich.), chairman, House committee on public works; and J. Harry McGregor (Ohio), chairman, House subcommittee on roads.

Congressman Dondero stressed the importance of concentrating more on solving urban traffic muddles. Studies in Detroit, he said, show that many car owners keep off the streets and roads for pleasure trips because of congestion. "Congestion, collision and confusion," he noted, "bring heavy loss to business and industry. About 25% of all gasoline consumed in metropolitan areas is burned while traffic is waiting to move. And a billion man-hours are lost yearly going to and from work in our cities, where half the nation's motor vehicle mileage is generated on streets representing only one-tenth of the total road and street mileage.

Diversion was the theme of Con-

● Hal H. Hale, for eleven years executive secretary of the American Association of State Highway Officials, has resigned to join the staff of the Association of American Railroads as assistant to the president and consultant on highway transportation.

gressman McGregor, who pointed to diversion of federal and state funds as "the chief reason our highway system is inadequate." The federal government's receipts from the two-cent federal gas tax, and excise tax on automotive products, are from 2½ to 3 billion yearly, he reminded. Congressman McGregor said he hoped the states will build roads where they are needed rather than where they will get votes but noted that Congress hasn't the power to tell the states where to build.

Du Pont Emphasized Research

In his Seattle talk, Commissioner du Pont praised the work of a committee appointed to evaluate the Bureau's research, composed of R. H. Baldock, E. R. Needles, McDonald, Harmer E. Davis, and Ben H. Petty. Their work has been turned over to a Highway Research Board committee, which among other things will soon be asked to advise on the desirability of designing a wind tunnel for testing bridge sections, primarily suspension bridges.

Commissioner du Pont noted the wide latitude on research granted by the 1954 Federal Highway Act. Under its terms the Bureau is now cooperating with several industrial firms on chemical stabilization projects. More companies are expected to sign cooperative agreements soon. The 1954 Act also helped make possible the action taken at the Seattle convention to expedite the Illinois road test.

During a busy research year in 1954, the Bureau has made studies as directed by Section 11 of the 1954 Act on problems relating to utility relocations, and on problems of highway financing under Section 13. Under Section 12 a new legal bill has been prepared for submission to the next Congress which will simplify interpretation of our new highway laws.

Many Technical Sessions

As usual the AASHO meeting was a many-ring circus of committee technical sessions. Subjects covered included geology, radio, maintenance, construction, research, bridges, materials, traffic, secondary roads, public relations, legal affairs, road design, right of way, finance, and administration.

Notes on selected topics from a few of the sessions are given herewith:

● *Bridges.* The unique practice of taking lump-sum bids on bridges by Massachusetts was discussed by J. C. Rundlett, bridge engineer, who said that low bids recently totalling $18 million were 10% under the estimate on this basis; the entire structure is bid in at a single sum. All contract items are listed in the plans and specifications but no quantities are given except for excavation, piling, approach work and a few other major items. Concrete, structural steel and many other quantities must be computed by the contractor bidding the job.

Advantages claimed for this method include cutting down on paper work by the department, less work load on state field staff and office engineers, time saved in the field in making out partial and final payments, elimination of arguments over quantities. No other state used this scheme, according to a survey.

● *Construction.* A paper by H. R. Craig, construction engineer, Ohio, noted that subgrade and embankment quality has been greatly improved since the adoption of earthwork specifications requiring moisture and density control in 1935. Successful compaction control, Craig said, requires a combination of a good specification, a practical field control procedure, and use of judgment factors in the application of field test data to secure compliance with specifications. Further research is needed on the efficiency of various types of rollers on different soils, and on the capabilities and limitations of vibratory rolling equipment. He urged contractors to take a more active part in such research.

The merits of using soil-cement under portland cement pavement, compared with granular subbase, was discussed briefly without a conclusive answer. Soil-cement while constructed as a road type in Washington state during the past four years is not used by this state as a p.c. concrete base.

Another question was on whether to break up old concrete prior to resurfacing with flexible bases or bituminous concrete. In Pennsylvania old pavement is left unbroken. Subsealing of old slabs prior to resurfacing is common practice, and subsealing is looked on as a maintenance operation to be done every few years as required by the base conditions.

Kansas experience in sawing concrete joints was reviewed in a paper by H. O. Reed, construction engineer. He noted the improvement in blades since sawing was initiated in 1950. Present revised specifications call for a somewhat reduced sawing depth (1¼ in.), 30-ft. spacing of contraction joints, optional sawing or steel strip formed longitudinal joint (mostly sawed today). All joints are sawed at 8 to 16 hours, the contractor being required to clean away the earth or paper curing cover along the joint location for this purpose and then replace it. Costs of sawing have dropped sharply compared with former years, reported Mr. Reed, who gave specific data on costs in his detailed paper.

● *Administrative.* The need to solve the right-of-way procurement procedure in preparation for a stepped up road program was stressed at this

Resolutions at Seattle

- Retiring Public Roads Commissioner du Pont was praised for his able leadership, and given vote of confidence in his new task as Special Assistant to Commerce Secretary Weeks; copy of resolution sent to the President.
- Hal H. Hale and G. H. Henderson, resigning as AASHO secretary and treasurer, respectively, were given a vote of thanks and appreciation for their outstanding service to the Association.
- AASHO endorsed need for more equitable navigation clearance requirements for highway bridges, and of a proposed Bill which gives highway transportation equal consideration with navigation; legislation recommended by the Hoover committee through its Task Force on Water Resources and Power.
- Urged federal enactment of legislation which would make highway right-of-way transactions exempt from Internal Revenue stamp tax.
- Reaffirmed the principle of national uniformity of road signs and markings, as set forth in the Manual of Uniform Traffic Control Devices for Streets and Highways.
- Asked a conference between AASHO, Bureau of Public Roads, and Association of American Railroads officials to work out an insurance tangle, now tied by federal memorandum and law to rail-highway cost aggrements on grade separation projects.

session, led by D. C. Greer, chairman of the AASHO administrative practices committee. Greer told of the Texas practice, whereby the counties or cities usually buy and furnish the right of way, free of obstruction. This frees state money for construction. Local governments are spurred by competition with other counties and cities. Counties purchase their land through an ad valorem tax.

The Texas highway department as a deliberate policy pushes advance planning far ahead, beyond the project volume which can be immediately financed for construction. This helps offset the time lag inevitable in securing land.

Presently the state has $120 million of projects in which right of way is "in the bag," and another $387 million of jobs for which right of way information is prepared.

Right of way will not get cheaper, said Greer. Texas is aided by a reservation law which permits the "blighting" of land which may take several years to finally acquire and pay for as funds become available.

In contrast, as described by R. H. Baldock, Oregon's department leaders feel that it is best to have unified responsibility for right of way acquisition. The state buys all land, under progressive new condemnation laws. The big thing, urged Baldock, is for everyone today to get surveys made and right-of-way information prepared for a large volume of advance work, in order to avoid a serious bottleneck later as the road program grows.

Ohio's doubled road program, said Director S. O. Linzell, has been hampered by the slow right-of-way procedure. This state, too, is getting out right-of-way descriptions far ahead of construction. The state law forbids taking any land not actually needed for construction, but much of the road work is in flat country where the standard right-of-way width will usually suffice.

Procurement of engineers and best use of available personnel were lively topics. One delegate told of shifting slow workers to positions for which they might be better fitted, as a constructive part of a weeding out process.

On the question of engineer pay, several states reported that overtime pay rates were paid for time in excess of 48 hours, but this custom usually does not extend to employes of project engineer status or higher. Some states are forbidden by law to pay overtime.

How to inject meritorious new research ideas and projects into state highway operation was covered by H. G. Schlitt of Nebraska. He noted that in 1952 only onehalf of one percent of the sum spent by the state highway departments, including federal aid, went for research ($18,000,000). This figure varied from 0.2% to 1.9% in the various states. He characterized highway research effort as being far too low, and below the limit that would be tolerated by industry. He also noted the superior ability of industry, spurred by competition, to speed the application of findings in practice. Campbell of the Highway Research Board staff was quoted as observing that "research is fact finding, not policy making." The policymaker's job, said Schlitt, is to see that research is given a high rank in the department's activities, including the functional action of scheduling, operation to carry out tests, reporting, and putting findings to work. Better internal administrative machinery is needed all along the line by some highway departments to make better use of research as a tool.

Several state representatives told of their respective set-ups to bring the construction, maintenance and other department heads into the picture in a committee action to integrate research with the over-all department operation. One state's methods in this respect include a full-time employe in the research department whose sole work is to compile and disseminate the findings of research to the rest of the staff.

Finally, it was noted, the administrator must see that design, maintenance, and construction practices are revised promptly where research shows the way to better highway service or lower cost or both.

Georgia's "human engineering" program was described by State Highway Engineer M. L. Shadburn. Research and testing work of a routine nature is done by students partly to develop their interest in highway engineering as a career; they are often given samples to test and report on.

Iowa's research council was described by Chief Engineer John G. Butter. It includes the deans of engineering at Iowa State College and Iowa University, state highway representatives, and six selected county engineers. This committee has functioned effectively, he said, and has given proper weight to secondary road problems.

● *Materials.* Discussion by various delegates on aspects of air entrainment of concrete revealed a trend or two. One is toward more prevalent use of the air entraining additive on the job, rather than in the cement. Another is an increase in the percentage of air in some states; however, according to one source, no scaling has occurred in pavements having more than 2% of air. Need for proper dispensing agent on the job was emphasized by all.

In a discussion on asphalt hot-mix control, committee chairman F. V. Reagel of Missouri said that in his state the contractor is now given specification limits for the mix and essentially designs the mix himself. The state laboratory then checks the mix and modifies it as necessary.

A better means of determining the actual productive capacity of a hot-mix plant is needed to insure good job control. Manufacturers were urged to cooperate in supplying candid ratings.

A discussion of concrete aggregates and aggregate tests brought out the usual problem of correlating the Los Angeles and the Duval test results. No practical correlation seems to be possible, several agreed.

One speaker (Arkansas) told of running both tests as part of the job routine, which enables the department to rule out a doubtful aggregate if it fails by either test.

What to do about steam boils in asphaltic mixes during rolling was brought up at this session, but not satisfactorily answered.

McCoy Heads AASHO

Officers elected to head the Highway Officials for 1955 are:

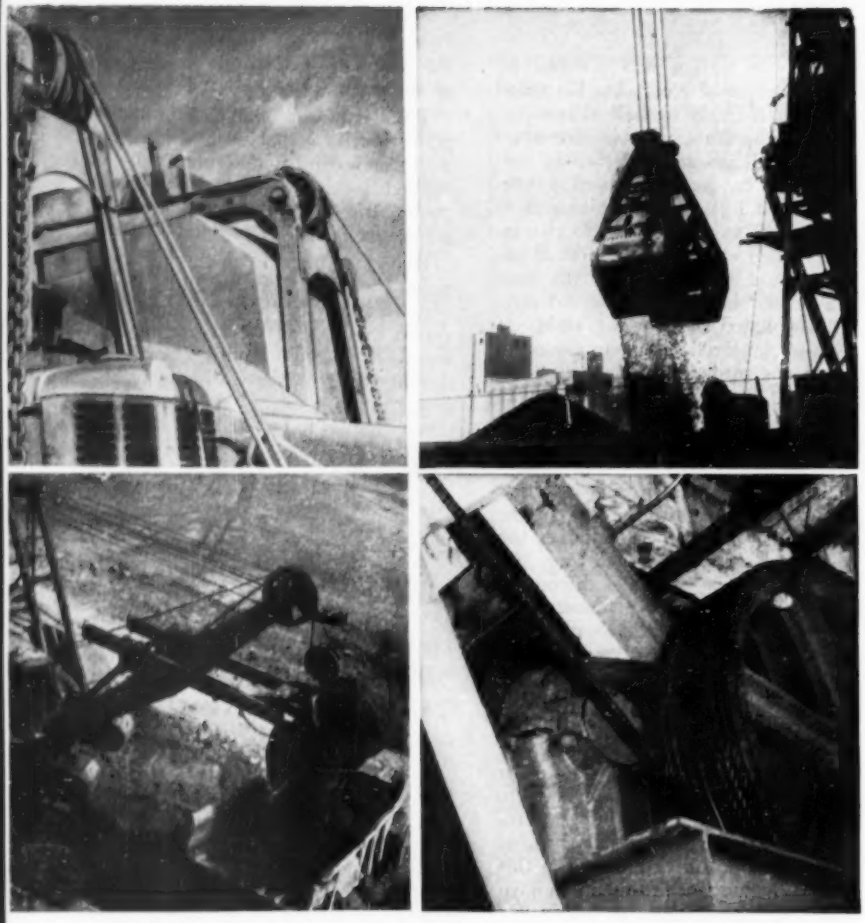
President: George T. McCoy, state highway engineer, California.

First Vice President: Frank D. Merrill, commissioner of highways, New Hampshire.

Regional Vice Presidents: John A. Volpe, commissioner of public works, Massachusetts; C. R. McMillan, chief highway commissioner, South Carolina; Ralph Bartelsmeyer, chief highway engineer, Illinois; W. A. Bugge, director of highways, Washington.

Executive Committee: Added to 10-man committee — Mark Watrous, Colorado (1955); George S. Covert, Louisiana (1956); R. H. Baldock, Oregon (1959); Rex M. Whitton, Missouri (1959).

Treasurer: Edward W. Kilpatrick, state highway engineer, New Jersey (replacing George H. Henderson, who has resigned after long service).



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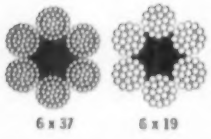

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Governor's committee endorses expanded program

One of the most important developments on the national "road front" in the weeks prior to the Clay Committee's expected report was endorsement by a special governors' committee of a six-point road policy. Proposing that the federal government contribute 25 billion in the next 10 years toward a $100 billion program, the committee recommended as follows:

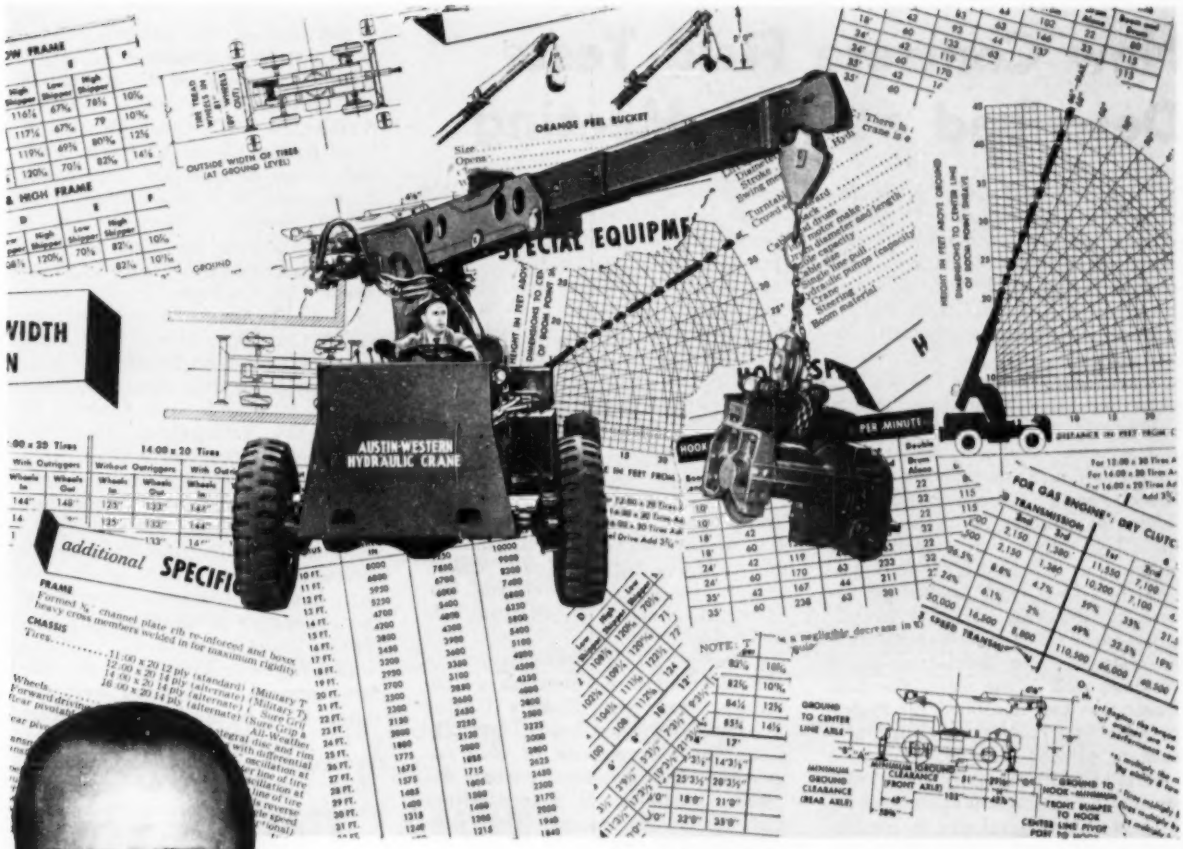
1. An adequate road program for the next 20 years will require twice the presently anticipated expenditure.
2. For financing, the various highway systems should be divided into three categories: (a) the interstate system, including essential urban access roads, (b) other federal-aid systems, and (c) state and local systems.
3. The federal government should assume chief financial responsibility for the interstate system, in light of defense and other national interests.
4. The federal $25 billion share of a 10-year program should be secured from general revenues, issuance of bonds, or by establishment of a national road financing authority.
5. States or their political subdivisions should be responsible for the actual construction, maintenance, administration and policing of their respective portions of the systems.
6. States and localities should continue to be responsible for constructing all systems other than the interstate with the provision that as long as the federal government levies fuel taxes it continue to make fund allocations to the states for road construction.

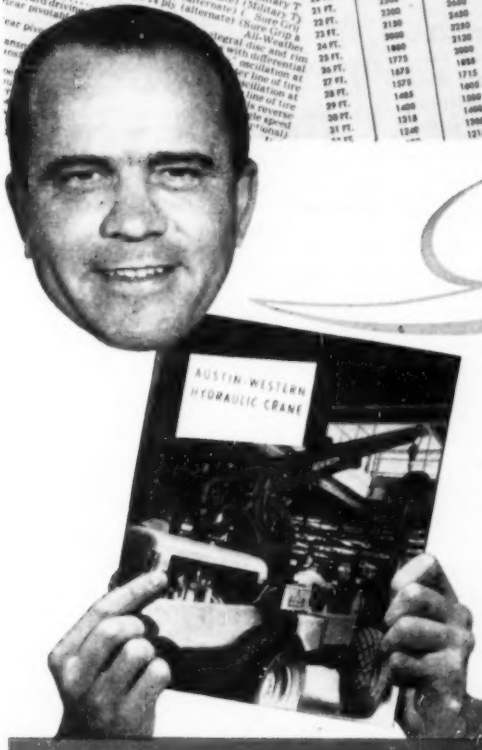
The governors' committee included Paul L. Patterson (Oregon), Allan Shivers (Texas), Walter J. Kohler (Wisconsin), Robert Kennon (Louisiana), Frank Lausche (Ohio), Howard Pyle (Arizona), Lawrence Weatherby (Kentucky), and John Lodge (Connecticut).

New Jersey installs "compass" type markers

North, south, east or west direction designations have been added to many route markers installed recently by the New Jersey State Highway Department.

These installations are at the junction of principal roads and important inter-changes between cities. Most important locations include reflectorized signs, made 8 x 19 in. for long distance visibility. Non-reflecting signs at lesser locations are 8 x 16 in. About 1600 such markers were planned for erection before the end of 1954.





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New Concrete Field Tests Described at ACI Meeting

TWO new field tests for concrete — one for measuring consistency of fresh concrete, the other for determining strength of hardened concrete — were described at the American Concrete Institute's regional meeting, Los Angeles, October 28-29, 1954.

J. W. Kelly and Milos Polivka, professor and assistant professor of civil engineering, respectively, University of California, Berkeley, described a simple field test for determining the consistency of fresh concrete in terms of the penetration of a 6-in. 30-lb. ball. The penetration principle for gaging the placeability of fresh concrete has long been applied in the form of drawing a shovel heavily across the surface, and in early days by observing the depth to which workmen sank in the mass. The ball-penetration test described by Professor Kelly and Polivka makes use of a constant gravity force to displace a volume of concrete in a manner comparable to construction operations.

The test was developed in the Engineering Materials Laboratory of the University of California and is now growing in use as a simple means of uniform control of consistency. The authors cited experiences of users and compared results with the well-known slump test. The California Division of Highways has adopted the ball test as a standard for field use on pavement construction. The North Carolina and Colorado state highway departments, as well as numerous other organizations, are using it extensively.

Gordon W. Greene, testing engineer, Pacific Coast Aggregates, Inc., Fresno, Calif., described another development — the Schmidt concrete test hammer. Frequently engineers and builders are faced with the difficult problem of measuring the strength of concrete in existing structures. Usually core samples cut from the concrete are relied upon to provide the desired information, but this is rather expensive. Then Ernst Schmidt, a Swiss engineer, developed a test hammer which could be used to measure the strength of concrete rapidly and inexpensively without damage to the structure. The test hammer utilizes the principle that the rebound of a steel hammer is proportional to the compressive strength of the concrete. Mr. Greene compared test hammer results with results of compression and flexure tests. He noted that the hammer does not offer the consistent accuracy of carefully performed compression tests, but its accuracy will probably be sufficient for most field checking — for example, checking strength growth in concrete prior to removing forms or shoring.

The same technical session also included the paper "Alkali-Aggregate Reaction — What It Is and What to Do About It," by Hubert Woods, director of research, Portland Cement Assn., Chicago, Ill., and "Determination of Cement Content of Concrete Before Hardening," by J. H. Walker, general manager, Research and Development Laboratory, Portland Cement Assn., Chicago.

Other papers of special interest in the road field were: "Strength of Continuous Prestressed Beams Under Static and Repeated Loads," by T. Y. Lin, associate professor of civil engineering and associate research engineer, Institute of Transportation and Traffic Engineering, University of California, Berkeley; and "Use of Large Tendons in Pre-Tensioned Concrete," by Niels Thorsen, Freyssinet Co., Inc., New York, N. Y.

W. R. Glidden of Virginia elected ASCE president

William R. Glidden, assistant chief engineer of the Virginia State Department of Highways, is the new president of The American Society of Civil Engineers. Installed at ASCE's annual convention in New York, October 18-22, he succeeds Daniel V. Terrell, dean of engineering, University of Kentucky.

William R. Glidden

The Society, the nation's oldest country-wide organization of engineers, also announced the election as vice presidents of Frank L. Weaver, Washington, D.C., Chief, Division of River Basins, Bureau of Power, Federal Power Commission; and Louis R. Howson, of Chicago, partner in Alvord, Burdick & Howson.

New Directors are Don M. Corbett, Washington, D.C., district engineer, U.S. Geological Survey; Lawrence A. Elsener, San Francisco; Jewell M. Garrelts, professor at Columbia University; Frederick H. Paulson, Providence, R.I.; George S. Richardson, Pittsburgh, and Graham P. Willoughby, Birmingham, Ala.

William N. Carey, executive secretary of the Society for the past eight years, announced his retirement just prior to the Society's New York convention. Succeeding him as associate secretary is W. A. Wisely, who for 15 years has been executive secretary of the Federation of Sewerage and Industrial Waste Associations.

The Highway Division of the Society, one of its thirteen technical wings, is to be strengthened as one of the chief aims of President-elect Glidden. He made this announcement while noting the great expansion pending in the nation's highway program. New highway committees on finance, traffic engineering, geometrics and possibly other subjects are contemplated along with a stepping up of activities in the local sections in behalf of the Society's 4,500 highway engineering members.

Feature of an all day technical program on highways was a luncheon talk by Commissioner of Public Roads du Pont. Discussing the possibility of a serious shortage of highway engineers to carry out the President's proposed road program, the Commissioner suggested that roadbuilding agencies make better use of their engineers. He urged more use of high school graduates as draftsmen and field and laboratory technicians.

Engineers Joint Council plans first assembly

The Engineers Joint Council, composed of 8 major engineering societies, total membership of 170,000, will hold a general assembly and a banquet on Jan. 21 in the Hotel Statler, New York City.

The basic theme will be the increase of unity in the profession, discussions will deal with the problem of engineering manpower shortage, employment conditions as they affect engineers, and the future usefulness of EJC.

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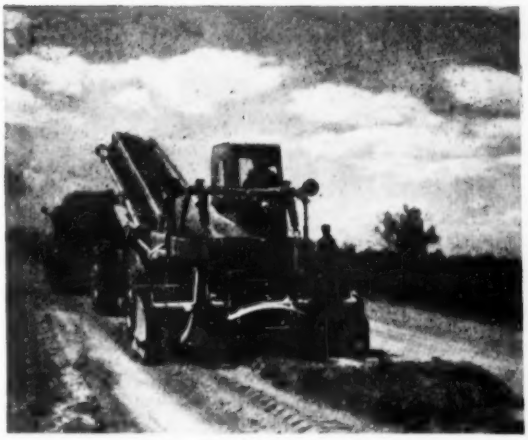
The 7-11 is designed for high capacity loading, but its low original cost and low operating cost put it within easy reach of any county or city budget. Ask your Athey-Caterpillar Dealer to show the features of the 7-11 that give you steady loading. He's at your service!



THE 7-11, *shown at top, is equipped with the tapered moldboard heavy-duty windrow loader front-end. Toe and heel adjustment permits the loader to follow the contour and crown of the road. Note the clean pick-up behind the loader. Above, a 7-11 with the auger-feeder, bulldozer moldboard, stockpile-windrow front-end arrangement. This loader can load material from stockpiles or from windrow.*

Athey

HIGH-PRODUCTION LOADERS

ATHEY PRODUCTS CORPORATION • 5631 West 65th Street, Chicago 38, Illinois

FREE BOOKLET

. . . For your free copy of the colorful new 7-11 catalog that shows how, where and why the 7-11 cuts costs with steady loading, write direct to Athey Products Corporation!

. . . for more details circle 164, page 16

Next job is only minutes away with

mobile trencher

Parsons rubber-tired Trenchmobile® runs anywhere at a moment's notice. A job 6 miles away can be started in less than 30 minutes from "now". Trenchmobile drives there cross-town, through traffic at 12.6 m.p.h. . . . digs the trench at speeds up to 14½ feet per minute . . . drives on to next job without delay.

This mobility on rubber is the answer to all those widely-scattered, small yardage trenching jobs where you formerly had to bring in cumbersome, oversize equipment, or use slow, costly hand labor. Trenchmobile is big enough, too, for a lot of main-line excavations. You get trench widths from 8 to 16 inches . . . depths to 5 feet, for water and gas mains, service connections, pipe reclamation, foundation footings, underground cables, lighting systems.

Let Parsons distributor show you how rubber-tired Trenchmobile can put your jobs on a fast "work-and-run" basis. Also check Parsons 5 big sizes of ladder and wheel-type Trenchliners®.

HOLDS ACCURATE GRADE . . . Positive down-crowd on the digging boom starts cut fast, maintains accurate grade. Buckets are high-carbon cast steel. Self-sharpening, easy-in-easy-out "Tap-In" teeth assure top digging efficiency at every width and depth, in all types of soil and job conditions.

BACKFILLS ITS OWN TRENCH . . . Backfill blade (optional) doubles usefulness of the Parsons Trenchmobile . . . lets you do the entire job of trenching and backfilling with one-man, one-machine economy. The husky six foot blade is readily adjustable from straight bulldozing to angled position . . . is raised and lowered by hydraulic control.

• • • • • *Send to:* **PARSONS CO., Newton, Iowa** • • • • •

for literature on 43.6 h.p., rubber-tired Trenchmobile

NAME_____

COMPANY_____

STREET_____

CITY, STATE_____ RS

(Trenching Subsidiary)

DODGES SIDE OBSTRUCTIONS . . . Shiftable, reversible belt conveyor places spoil bank on either side of trench . . . lets Parsons Trenchmobile work in close to buildings, poles, without swerving from grade line.

UNDERCUTS SIDEWALKS . . . With reverse traction and sloping ladder boom, Trenchmobile undercuts walks, curbs, gutters, old mains . . . makes vertical cut-ins, flush against foundation walls. Saves hand work. Hinged crumber swings up, out of the way.

Hauls 1-ton load in gravity-dump hopper

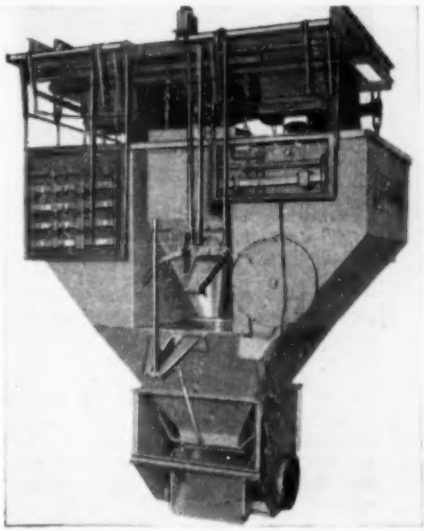
New Kwik-Mix R15 Moto-Bug® carries 2,000 pounds of any bulk materials in 15 cu. ft. hopper, or on 34x54-in. platform. It travels 6 m.p.h. forward and reverse, climbs 16% grades fully loaded, has 550 pounds drawbar pull for towing. Turning radius is only 73 inches; overall width is 35 inches. R-15 Moto-Bug can be equipped with 7-foot fork lift. Smaller 10 cu. ft. Moto-Bug with 34x48-inch platform and 6-foot fork lift also available.

KWIK-MIX • Milwaukee, Wis.
(Koehring Subsidiary)

Central cement feed prevents "gumming"

With concentric arrangement of aggregates around cement in the Johnson Concentric Batcher, all ingredients are intermingled as they flow through discharge. Reduces dusting, pre-shrinks materials. Cement is weighed individually on precision-beam scale; aggregates on accumulative dial scale or individual beam scales. Johnson Concentric Batcher sizes: 2 to 8 cu. yds., arranged for 2 to 8 aggregates, 1 to 4 types of cement.

C. S. JOHNSON • Champaign, Ill.
(Koehring Subsidiary)



Compare Koehring 205 with any other ½-yard

Crowd, swing, boom-hoist and retract clutches on Koehring heavy-duty 205 are among the largest used in the ½-yard class. Powerful cable crowd and electric push-button dipper trip maintain fast dig-and-dump cycles. Automatic traction brakes simplify operation, lock and hold the 205 when working or parked. Work capacity: ½-yd. shovel or hoe; ½ to ¾-yd. clamshell or dragline; 10-ton lift crane on crawlers; 15-ton truck crane.

KOEHRING Company
Milwaukee 16, Wis.

T62

. . . for more details circle 192, page 16

What's New
in Equipment and Materials

(See Page 16 for Reader Service Coupon and more items)

Goose Neck Back Hoe Attachment

A new goose neck back hoe attachment, announced by Little Giant Crane & Shovel, Inc., E. 16th and Howard Drive, Des Moines, Ia., is claimed to give superior digging and dumping action. It is standard equipment for the ¾, ⅞ and 1 cubic yard machines. The ½ cu. yd. has a digging depth of 19 ft. 5 in. on crawler mounting and a dumping height of 8 ft. 6 in.

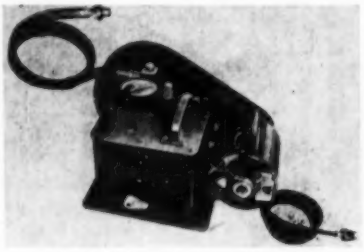
Little Giant Goose Neck Back Hoe Attachment

The Little Giant base machine has a patented ball bearing turntable. Simple, patented clutches — easy adjustment. Self-aligning roller bearing construction on all shafts lubricated and sealed for life — expectancy being 15,000 hours. Patented clutches with split spiders simplifies field maintenance and adjustments. Available on crawlers, or truck mounting. Fully convertible to other attachments.

For more information circle 107 on Service Coupon Page 16 and mail now.

New OTC Hydraulic Pump

A new, simplified, electrically driven hydraulic pump for use in operating their versatile Power-Twin rams has been announced by the Owatonna Tool Co., 435 No. Cedar St., Owatonna, Minn. The new pump is equipped with a G. E. ⅓ HP motor with capacitor start and induction run. The 1725 rpm, 115 volt AC, 60 cycle motor has open, dripproof, all angle, sleeve bearings and is equipped with automatic reset and overload protection. The pump is a single piston, reciprocating type, belt driven capable of delivering 10,000 psi in intermittant service and 6000 psi for continuous service. This pump will operate all four OTC Power-Twin rams of 17½, 30, 50 and 100 ton capacity faster and with greater efficiency than any hand-operated pump. Motors with different characteristics may be supplied for special requirements.



OTC Hydraulic Pump No. Y-24

For more information circle 108 on Service Coupon Page 16 and mail now.

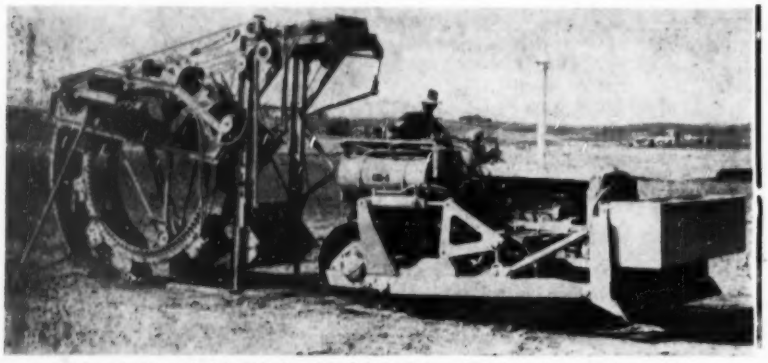
Ditcher Attachment for Tractor

The new Unimatic ditcher, Model CW-4 is now in full production by Unimatic Corporation, P. O. Box 1166, Tulsa, Okla., and is available for immediate delivery. The ditcher is an attachment for Caterpillar diesel D-4 tractor and can be detached within 30 minutes or less. The Model CW-4 ditcher will dig to a maximum depth of 5 ft. 6 in. with the width of cut ranging from 15 in. to 24 in. in increments of 1 in.

It is an all hydraulic unit with all controls within the normal reach of the seated operator. The Unimatic drive permits the ditcher to move forward at any speed from zero to 26 ft. per minute. Unimatic's completely new conveyor starts, stops and reverses instantaneously, and is completely independent of the digging wheel. Improved pulley design eliminates lateral belt travel and the new rubber guides and single pins contribute greatly to the efficiency and life of the conveyor belt.

The length of the CW-4 ditcher with a straight bulldozer is 22 ft. 8 in. The width with a straight bulldozer is 8 ft. 3 in. and the overall height is 9 ft. 11 in. The weight of the ditcher ranges from 6,660 lb. to 6,930 lb. and is easily transported with the tractor from job to job in one load.

For more information circle 109 on Service Coupon Page 16 and mail now.



Unimatic Detachable Ditcher Model CW-4 on Testing Area, Tulsa, Okla.

3½ Yd. Truck Mixer

A new 3½ yd. Rocket truck mixer has been added to the line of drum-type mixers of Concrete Transport Mixer Co., 4985 Fyler Ave., St. Louis 9, Mo. This new model embodies the same popular features of their other revolving-drum mixers: hydraulically-operated chute control, with permanently attached "flip-flop" chute and heavy-gauge light-weight aluminum detachable extension chute; Timken-Detroit reduction unit; flexibility of a chain drive; standard electrically-operated revolution counter; and an industrial engine choice, including Continental.

Model 35 Rocket Truck Mixer

For more information circle 110 on Service Coupon Page 16 and mail now.

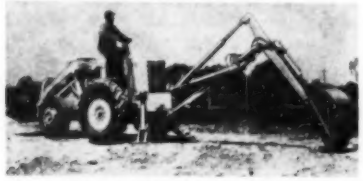
Root Cutter Speeds Land Clearing

Used with the Ateco rock ripper for Caterpillar D8 tractors, a new root-cutting blade capable of penetrating 30 in. below ground surface and cutting roots up to 10 in. to 12 in. in diameter has been developed by American Tractor Equipment Corporation, 9131 San Leandro Blvd., Oakland, Calif. The new root knife replaces the usual ripper standards on the Ateco rock ripper, making a compact tractor-mounted root-cutting tool that can work anywhere the tractor can. In practice, the operator lowers the hydraulically-controlled root knife close to the tree and makes a few deep passes to cut the supporting roots. The 860-lb. blade is made of heat-treated alloy steel 3 in. thick and 18 in. wide at the bend, tapering to a 10⅝ in. width at the point, sharpened and hard-faced on one edge.

For more information circle 111 on Service Coupon Page 16 and mail now.

New Back-Hoe for Hough Payloaders

A back-hoe, designed specifically for the Hough Payloader, has been announced by the Wain-Roy Corporation, Hubbardston, Mass. Completely hydraulic, it is designed to apply tremendous digging power, combined with fast retracting action, to speed up the entire operating cycle. The "wrist-action" bucket also speeds up digging, because the hoe does not have to go through the complete cycle on all digging operations. The boom design and bucket action permit digging vertical bell holes, vertical side walls, square corners and maintain a smooth, level grade at the bottom of trenches. It provides an effective digging depth of 12 ft. 6 in. below grade.



Hough Payloader with New Back-Hoe

An unusual feature of design is the ability to dig trench and dump spoil at any radius up to 190°, enabling the unit to reach those "hard-to-get-at" spots. The hoe itself does not interfere with the normal Payloader functions such as backfilling, excavating, etc. It may be easily removed in ½ hour if desired and attached in less than an hour.

For more information circle 112 on Service Coupon Page 16 and mail now.

New Line Self-Propelled Concrete Saws

A new line of gasoline-powered concrete saws, with optional self-propulsion. Model C-250 (25-HP) and Model C-146 (14.6 HP), have been announced by Clipper Manufacturing Co., Suite 749, 2800 Warwick, Kansas City 8, Mo. Both saws are designed for continuous heavy duty, such as cutting contraction joints in new concrete, (highways, airports, and warehouse floors), and sawing the boundaries of sewer and utility trenches in old pavement. Power for propelling the Clipper concrete saw is supplied from the gasoline engine to a variable speed transmission. Two abrasive-coated drive wheels maintain positive traction without slippage, under the most unfavorable conditions. Speed of the saw is infinitely adjustable, from zero to approximately 12 ft. a minute. Toe pedals, easily reached from operating position, engage and disengage the transmission. Two-wheel drive holds the saw on a true course for cutting a straight line, without drifting and consequent extra blade wear. Another feature which keeps the saw moving in a straight line is the rigid 4-wheel mounting of the saw chassis. This is made possible by a patented floating front axle. In effect, the blade is suspended on 3 points — when the saw wheels pass over an uneven surface, the blade remains straight in the cut, without twisting, and with minimum binding.

Model C-250 Clipper Concrete Saw Cutting Contraction Joints in Concrete Slab on New 6th St. Trafficway, Kansas City

For more information circle 113 on Service Coupon Page 16 and mail now.

Tools for Flaring, Cutting and Bending Copper Tubing

A compact set of tools for flaring, cutting and bending copper tubing from 3/16 in to ⅝ in. in seven sizes of standard thin-wall untempered tubing, has been announced by Owatonna Tool Co., 435 N. Cedar St., Owatonna, Minn. The set consists of a flaring tool No. 835-S designed to flare tubing in 3/16 in., ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in. and ⅝ in. diameters, a tubing cutter No. 837 with a capacity from 3/16 in to 1 in. and a set of six spring steel coiled sleeves which permit bending copper tubing from ¼ in. to ⅝ in. without collapsing or buckling the tubing. The complete set is contained in a neat metal case. (No. 854)

Tools for Flaring, Cutting and Bending Copper Tubing

For more information circle 114 on Service Coupon Page 16 and mail now.

Sinclair Announces New Fast Engine Starter

A new type of diesel and gasoline starting fluid applicator, the first to automatically meter the proper amount of starting fluid to the engine, has been placed on the market by Sinclair Refining Company and the Automotive and Marine Products Corporation. Known as the Ampco-Sinclair Engine Starter, the new device was developed by Sinclair Research Laboratories, Inc., in conjunction with Ampco and is being manufactured by the latter firm.

The starter provides automatically the proper amount of fast-igniting engine starting fluid needed to begin normal fuel firing when diesel engines are cold. Diesel engines, which are fired by the heat of compression in regular operation, are normally cranked by battery-powered motors or by auxiliary gasoline engines. When an engine must be stored and started at low temperatures, a quick injection of a fast-igniting fluid is necessary to aid starting and sustain combustion until the regular fuel maintains engine operation. Gasoline engines operating in cold temperatures may also need such starting fluid.

The starter works automatically in injecting the right amount of starting fluid at the proper rate of fluid flow for any

(Advertisement)

POWER AUTHORITY OF THE STATE OF NEW YORK
ST. LAWRENCE POWER PROJECT
ADVERTISEMENT FOR PROPOSALS FOR THE FURNISHING AND DELIVERING OF CONCRETE AGGREGATES NEAR MASSENA, ST. LAWRENCE COUNTY, NEW YORK
SPECIFICATION NO. PA-5-11013
ST. LAWRENCE CONTRACT NO. P4

• • • • • • • • • •

NOTICE TO CONTRACTORS: The POWER AUTHORITY OF THE STATE OF NEW YORK will receive sealed proposals for the production, furnishing, and delivery of concrete aggregates to Massena, New York until 10:30 A.M. Eastern Standard Time on the 21st day of December 1954 at the Authority's Office, 270 Broadway, Room 1207A, New York 7, New York, at which time and place proposals will be publicly opened and read aloud.

The principal items are:

Estimates:

800,000 tons Natural or Manufactured Sand Fine Aggregate,

1,700,000 tons Crushed Rock Coarse Aggregate in four grades.

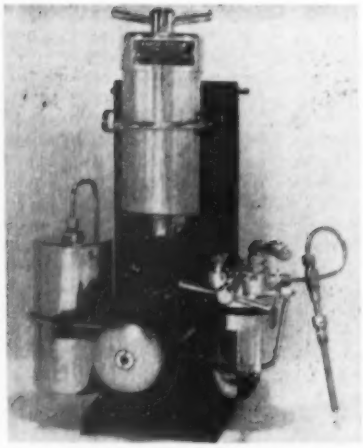
Specifications and Proposal Forms are on file in the Authority's office and in the office of the Engineer, Uhl, Hall & Rich, 230 Congress Street, Boston 10, Massachusetts, and the Hydro-Electric Power Commission of Ontario, 620 University Avenue, Toronto 2, Ontario, and may be inspected by prospective bidders during office hours.

Specifications and Proposal Forms may be obtained from the Power Authority of the State of New York, 270 Broadway, Room 1300, New York 7, New York after November 15, 1954, upon application and prepayment of a fee of Five ($5.00) dollars per set of two bound copies of contract documents, no part of which will be refunded.

Bids must be made in duplicate upon the proposal forms included in and bound with contract documents. Guarantee will be required with each bid in an amount not less than 10 percent of the maximum price bid.

The right is reserved to reject any or all bids.

—W. S. CHAPIN
GENERAL MANAGER



Ampco-Sinclair Engine Starter

engine by even an inexperienced operator irrespective of engine design, size or temperature conditions.

In special cold room tests at the Sinclair laboratories in Harvey, Ill., the new unit provided rapid engine firing at temperatures down to minus 40 degrees Fahrenheit. The starter utilizes the aerosol principle as opposed to solid starting fluid injection. It has a closed pressurized circuit which eliminates fumes and fire hazards. Tests show that average costs of less than 5c per start were obtained with the Ampco-Sinclair Engine Starter using Sinclair Starting Fluid.

For more information circle 115 on Service Coupon Page 16 and mail now.

Light-Weight, Low-Cost Vibrating Screen

Although capable of capacities in excess of 300 tons per hour, Barber-Greene's newly announced "Redi-Flow" vibrating feeder is nonetheless a light-weight, low-cost unit. This desirable combination is achieved through the use of a simple, ingenious and highly effective mechanical vibrating device. The "Redi-Flow" is made in 20 and 26 in. widths for feeding 24 and 30 in. belts, respectively. Lumps up to 12 in. in size can be handled, when mixed with fines, or to 8 in. maximum when the lumps are of uniform size. Capacity is, of course, dependent upon the size and type of material handled, but averages 200 tons per hour for the 20 in. unit and 300 tons or more, with the 26 in. unit.

The "Redi-Flow" feeder draws its effectiveness from the fact that the entire feeder and hopper are continuously vibrated by the eccentric action of counterweighted flywheels. This also makes accurate regulation of capacity possible by any of three means: by changing the weights on the flywheels, by altering the slope of the feeder itself, or by changing the amount of weight on the control gate.

"Redi-Flow" Vibrating Feeder

Several operational features of the "Redi-Flow" feeder contribute to maximum belt protection. The short stroke and compactness of the unit permits discharge very close to the belt and thus prevents impact damage to belt or carriers. Vibration in the hopper as well as in the feeder itself prevents segregation and seats heavy lumps in a bed of fines. Material is propelled in the direction of belt travel at the moment of transfer from feeder to belt and finally, the "Redi-Flow" promotes proper belt alignment by concentrating the load directly and evenly in the center of the belt.

Detailed information and complete specifications on the "Redi-Flow" feeder may be obtained by writing to Barber-Greene Co., 400 No. Highland Ave., Aurora, Ill.

For more information circle 116 on Service Coupon Page 16 and mail now.

Self-Cleaning Hi-Lift Bucket

A fully automatic self cleaning bucket for front end loaders has been developed by W. A. Baker, 28 Sharp Ave., Washington, Pa. It has dual driving chains, one on each side which run from the dumping arm hinge pin which is the driving shaft to the front hub. At the front hub it has a U-shaped cleaner attached. It is powered from the dumping arms through twin coil springs which serve as a resilient link. This set of springs makes it fully automatic for use in rocks as well as dirt. The bucket will

You Get Greater Profits from Smaller Investment with this All-Purpose Unit

SCHRAMM AIR COMPRESSOR..TRACTOR..BACKHOE..LOADER
ENTIRELY DESIGNED & BUILT BY SCHRAMM, INC.

SCHRAMM BACKHOE AND SHOVEL
- Digs faster than cable-operated backhoe
- Twice the power of backhoes on agricultural type tractors
- With shovel bucket, operates smoother, outperforms all other ¼ yard shovels

SCHRAMM LOADER
- Bucket capacity full cubic yard
- Lifts 2500 pounds

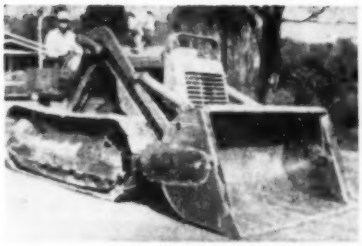
The Schramm Pneumatractor with new Backhoe and Loader gives you a 125 c.f.m. air compressor . . . tractor . . . backhoe . . . shovel . . . loader . . . crane . . . sweeper . . . snow plow . . . bulldozer . . . backfill tamper . . . platform scaffold . . . winch . . . auger . . . wagon drill!

For complete details, write today for illustrated booklet.

SCHRAMM, INC.
The Compressor People
WEST CHESTER • PENNSYLVANIA

Schrammair YOUR JOB!

. . . for more details circle 207, page 16



Self-Cleaning Bucket

soon be on the market in two sizes: one to fit the Caterpillar D4 hydraulic, the other to fit Allis-Chalmers HD 5 tractor.

For more information circle 117 on Service Coupon Page 16 and mail now.

Tractor Jumbo Mobile Drilling Unit

A completely self-contained mobile drilling rig has been announced by Gardner-Denver Co., Quincy, Ill. The complete outfit consists of Gardner-Denver rock drills on long feed mountings, Gardner-Denver hydraulic booms, and a complete Gardner-Denver air compressor for powering the drills, all mounted on a Caterpillar D-8 Tractor. Gardner compressor assemblies are available in capacities of 600 cfm, 500 cfm, 365 cfm and 315 cfm for direct connection to the rear power take-off of D-8 Tractors. Hydraulic booms are available in various lengths.

A choice of several drill sizes and several types of feed mountings provides the opportunity to have a tractor-mounted jumbo unit tailored to individual job requirements. Remote controls, which permit all drilling and positioning operations to be controlled from a central station on the tractor for one-man operation, are also available.

Mobile Drilling Rig

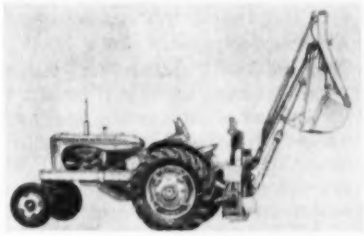
For more information circle 118 on Service Coupon Page 16 and mail now.

Backhoe Added to A-C Line

The line of excavating and materials handling equipment of Allis-Chalmers Manufacturing Co., Tractor Division, Milwaukee 1, Wis., has been expanded by adding the Model WD-45 wheel tractor equipped with the Henry backhoe. Other Henry hydraulically operated attachments including backfiller blade, straight and angle dozers and front-end loader, are also available for the WD-45. Weighing approximately 4,000-lb., the WD-45 is powered by the Allis-Chalmers "Power-Crater" gasoline engine, a valve-in-head design unit developing 45 hp.

Making up the basic unit is the WD-45 tractor and the Henry backhoe. Attachments include five buckets 16 to 24-in. interchangeable with the backhoe for use in stockpiling, truck loading and other dirt moving jobs. Maximum loading height (rear mounted unit) is 9 ft.

Front-mounted attachments include the ¾ cu. yd. front-end loader for digging and loading; a backfill blade for light dozing and clearing, stockpiling, snow removal, cleanup and general maintenance work. There is also a lift fork, crane hook, and straight and angle dozers. A feature of the WD-45 are its "Power-Shift" rear wheels which permit the operator to quickly adjust rear wheel tread with engine power to the width required for maximum stability.



Model WD-45 with Henry Backhoe

For more information circle 119 on Service Coupon Page 16 and mail now.

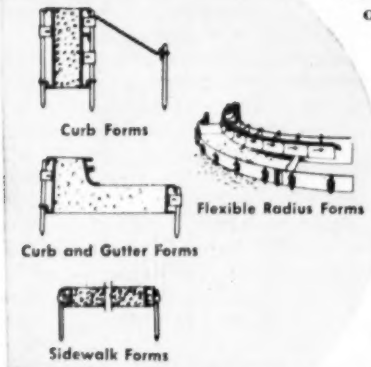
For more ideas on Equipment and Materials . . . . . see page 84

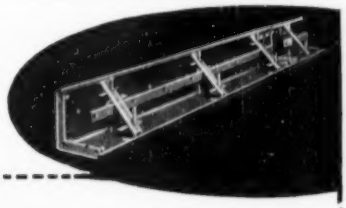
Get the *"Complete Package"* of BLAW-KNOX UNIVERSAL FORMS

SAVE HALF

ON CURB, GUTTER AND SIDEWALK JOBS

HERE'S the fastest way to cut concrete forming costs you ever saw. *One "Complete Package"* of Blaw-Knox Steel Forms handles *every* concrete curb, curb and gutter or sidewalk job, from simple straight work to curved or serpentine shapes. They're standardized for complete interchangeability! You can use them over and over again in combinations to meet an almost endless variety of specifications. Expensive carpentry, especially on curves, is eliminated. You save on costly materials, too. Easy to set, strip, handle and transport. Maintenance is practically non-existent. See your Blaw-Knox distributor for additional details.





Blaw-Knox Heavy-Duty Road and Airport Forms

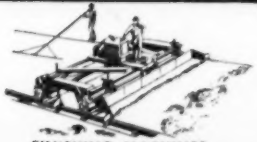
You get faster form setting, *always true to line and grade*, with Blaw-Knox Self-Aligning Steel Paving Forms. Available in heights of 8" or more, or in Dreadnaught Forms under 8" height. 12" x 12" Heavy-Duty Forms and Airport Paving Forms in sizes above 12" designed for the thicker slabs of modern airport runways.

BLAW-KNOX COMPANY
BLAW-KNOX EQUIPMENT DIVISION
PITTSBURGH 38, PA.
Offices in Principal Cities

Ask about the Blaw-Knox "COMPLETE PACKAGE" of CONCRETE PAVING and READY-MIX EQUIPMENT

HI-BOY TRUKMIXERS

AGGREGATE BATCHING PLANTS


FINISHING MACHINES

CONCERTE SPREADER-VIBRATORS

. . . for more details circle 170, page 16

Chart Method Gives Unit Weight of Crushed Base Stone

By C. H. Turner
District Geologist, Missouri State Highway Department, Springfield

Presented here is a chart method for determining dry unit weight of crushed stone base materials containing Plus 4 fraction. Now a standard method of the Missouri State Highway Department, it gives field inspectors who check base compaction a quick, accurate and easy method of determining the weight per cubic foot of compacted stone.

MISSOURI specifications require that compaction shall be at least 95 per cent of the standard maximum weight per cubic foot as determined by AASHO test T99-49, and that density determinations shall be made in accordance with procedures set forth in AASHO test T147-49.

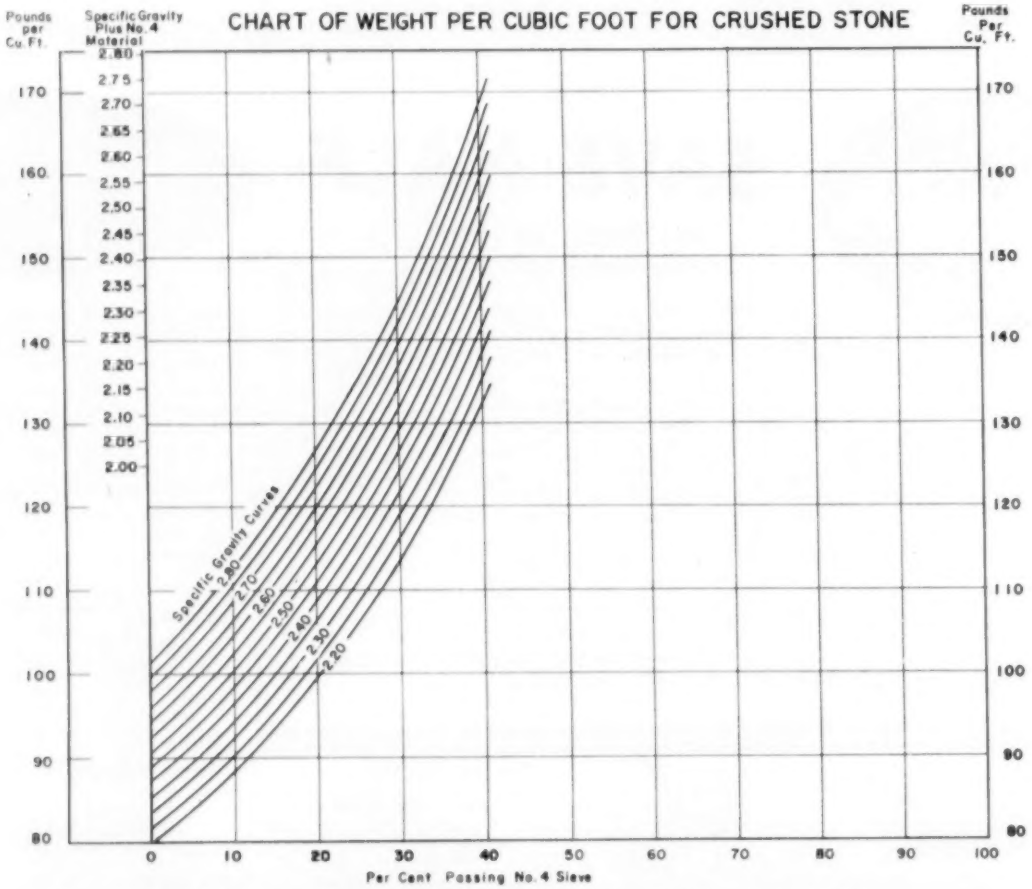
One of the advantages of this method is that only one chart is used; whereas two nomographs and a weight chart were required by previous procedures. As a result, several sources of error have been eliminated and the number of required calculations reduced to a minimum.

It must be remembered, however, that this chart method applies only to crushed stone. Until more data have been accumulated, other procedures must be used for materials such as gravel, slag, and soil-aggregate.

Throughout this discussion the term "unit weight" shall be used for the terms "weight per cubic foot," or "pounds per cubic foot."

Basis of Chart

Tests made on crushed stone base materials in Missouri, from 12 different geological formations with varying physical properties, indicate that the average void content of the Plus 4 material can be validly assumed as 42 percent. The extreme variations from this average value are not greater than those variations that might be expected from normal sampling and testing procedures of field and laboratory.



● Chart for determining the combined dry weight per cubic foot of crushed stone base material.

When this unit weight for materials with 0 to 40 per cent passing the No. 4 sieve are plotted, it is found that they do not fall on a straight line but on a curve which is sharper at the lower end, with the degree of curvature decreasing at the 40 per cent limit. Since most specifications require at least 30 per cent passing the No. 4 sieve, the flatter part of the curve is all that needs to be considered for our purpose. The curves shown on the new chart have been calculated for 0.05 increments in specific gravity.

The vertical and horizontal scales give the specific gravity and corresponding unit weight of the Plus 4 fraction, the compacted dry unit weight of the Minus 4 fraction, and the percentage passing the No. 4 sieve.

Use of the chart requires prior determination of the compacted dry unit weight at optimum moisture content for the material passing the No. 4 sieve by AASHO method T99-49; specific gravity of the Plus 4 fraction by AASHO method T85-45; and percentage of material passing the No. 4 sieve.

Procedure

(1) The specific gravity of the Plus 4 fraction is plotted on the left vertical scale. This point represents the solid unit weight of the material retained on the No. 4 sieve and, also, zero per cent (0%) passing the No. 4 sieve.

(2) The compacted dry unit weight of the Minus 4 fraction, as determined by test, is plotted on the right vertical scale. This point also represents 100 per cent passing the No. 4 sieve.

(3) A third point is then calculated for 50 per cent passing the No. 4 sieve. The three points are then connected by a smooth curve, approximately 0 deg. 35 min., with some variance for different materials.

(4) Next, the specific gravity of the coarse portion of the sample is located in the family of curves. If the specific gravity lies between two of the plotted curves, an interpolation must be made. The intersection of this curve (plotted or interpolated) with the curve drawn in (3) establishes the % at which the voids in the Plus 4 fraction are exactly filled with the Minus 4 material.

The accompanying example illustrates this procedure when the Minus 4 material content in a sample is more or less than the amount necessary for filling exactly the voids of the Plus 4 fraction.

Data for Two Samples

Compacted unit dry weight of Minus 4 material (lb. per cu. ft.)	130.4
Specific gravity of Plus 4 material	2.57
Material passing No. 4 sieve	
Sample I	47%
Sample II	32%

Calculations

1. Plot 2.57 specific gravity on left vertical scale. This also corresponds to 160.4 lb. per cu. ft.

2. Plot 130.4 lb. on right vertical scale.

3. Calculate the third point by the following method:

$$\frac{160.4 \times 130.4 \times 2}{160.4 + 130.4} = 143.9$$

4. Plot 143.9 on the 50 per cent line and draw a smooth curve to connect the three points.

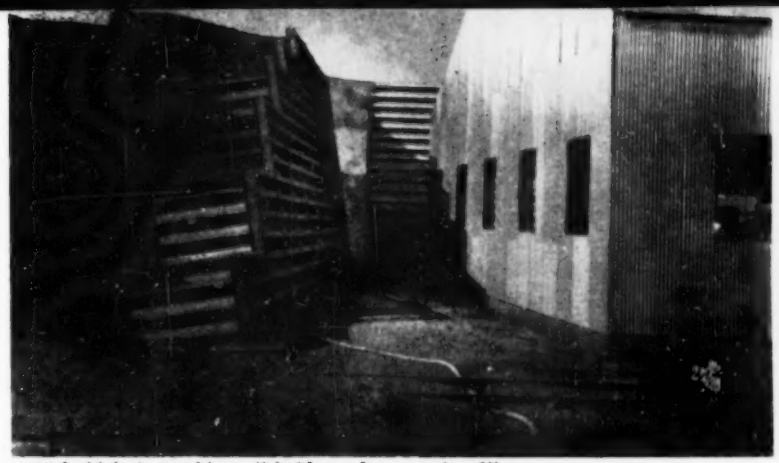
5. Pick out the point at which the 2.57 specific gravity curve intersects the above curve. This is the percentage of Minus 4 material which exactly fills the Plus 4 voids or 37.2 per cent.

Test Sample I

Since the percentage of Minus 4 in this sample is 47 per cent, which is greater than the percentage determined in Step 5, follow the curve plotted in Step. No. 4 rightward to the percentage found in the sample (47) and read the combined dry unit weight from either vertical scale, 144.8 lb. per cu. ft.

Test Sample II

Since the percentage of Minus 4 in this sample is 32 per cent, which is less than the percentage determined in Step No. 5, follow the 2.57 specific gravity curve downward to the percentage found in the sample (32) and read combined dry unit weight from either vertical scale, 136.6 lb. per cu. ft.



● 28-ft. high Armco bin wall holds grade separation fill.

Steel bin-wall helps restrict overpass fill

The accompanying photo shows how the slope of an overpass embankment on U.S. 60 near Owensboro, Kentucky, was confined where an adjacent industrial building encroached into the normal slope area.

The wall was constructed to 28 ft. height using armco bin wall. This type of construction was elected by the contractor rather than the alternate of concrete cribbing, according to an Armco bulletin, because the steel construction permitted the speediest job.

The center section was specially fabricated under a design worked out by the Kentucky highway department bridge engineers and the Armco organization. The wall is L-shaped, a 70-ft. section holding fill back from the building and a short "L" leg protecting the front of the side of the building.

Contractor: Foster & Creighton, of Nashville, Tenn.

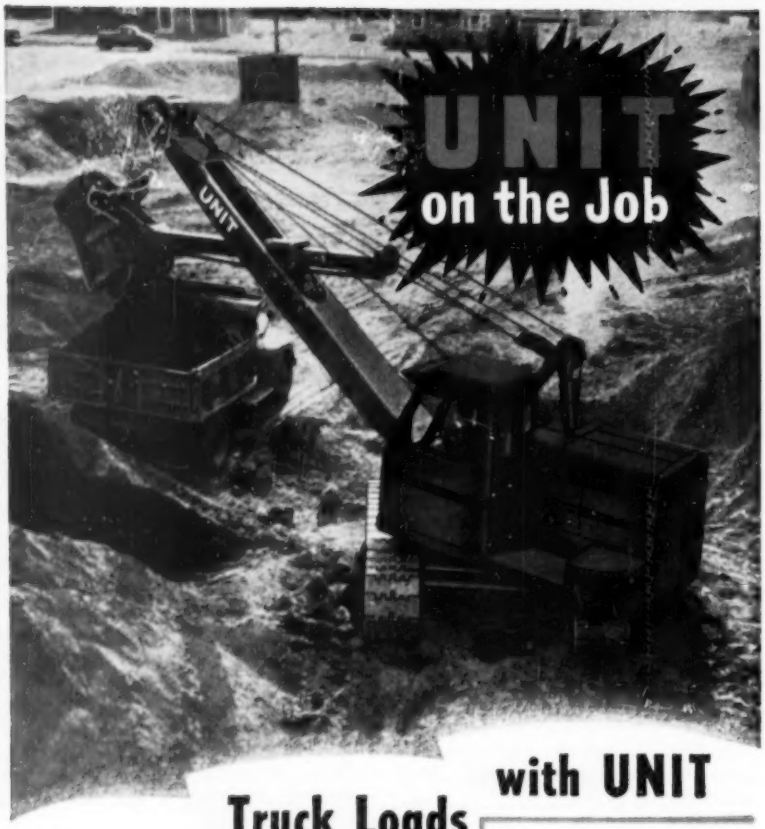
New estimating manual

"Estimating Production and Construction Costs", by Louis Dallavia, construction estimator. Published by Dallavia Company, 2110 Elmen St., Houston 19, Texas. 257 pages. Price $15.00.

This new major reference, perfected in 22 years of actual estimating practice and tested by contractors, architects and construction engineers, is designed to help estimate more accurately than has heretofore usually been possible with only local production and construction cost data. Techniques said to be new are presented, including 160 tables.

Chapters are included on earth work production costs (power shovels, draglines, tractors, scrapers, wagons, rollers, dozers and truck hauling); concrete production costs (fabricating, erecting, stripping wood and metal forms, reinforcing, concrete placing and finishing); structural steel production costs (erection, riveting, welding).

An extensive appendix provides much useful construction data. Copy available by remitting to address given above.



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All Models Convertible to ALL Attachments!

. . . for more details circle 216, page 16 A 7312-⅔-PC

Meetings Ahead

NATIONAL SAND AND GRAVEL AND NATIONAL READY MIXED CONCRETE ASSOCIATIONS, — Annual meeting, Miami Auditorium, Miami, Fla.; Jan. 9-13.

AMERICAN ROAD BUILDERS ASSOCIATION — Annual meeting, Roosevelt Hotel, New Orleans, La.; Jan. 10-13.

CONSTRUCTION INDUSTRY MANUFACTURERS ASSOCIATION — Annual meeting in conjunction with ARBA meeting, New Orleans in January.

HIGHWAY RESEARCH BOARD — Annual meeting, Washington, D.C., Jan. 11-14.

ASSOCIATED EQUIPMENT DISTRIBUTORS, INC., — 1955 meeting, Conrad Hilton Hotel, Chicago, Ill.; Jan. 23-28

NATIONAL CRUSHED STONE ASSOCIATION, —Annual convention, Netherland Plaza Hotel, Cincinnati, O.; Feb. 7-9.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS — Annual meeting, Jung Hotel, New Orleans, La.; February 7-9.

AMERICAN CONCRETE INSTITUTE — Annual convention, Schroeder Hotel, Milwaukee, Wis., Feb. 21-24.

ASSOCIATION OF HIGHWAY OFFICIALS OF NORTH ATLANTIC STATES — Annual meeting, Traymore Hotel, Atlantic City, N. J.; March 2-4.

AMERICAN CONGRESS ON SURVEYING AND MAPPING AND THE AMERICAN SOCIETY OF PHOTOGRAMMETRY — Annual meetings, Hotel Shoreham, Washington, D. C.; March 7-11.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA, INC. — Annual convention, Roosevelt and other Hotels, New Orleans, La.; Mar. 14-17.

"MODEL ANALYSIS OF STRUCTURES," by T. M. Charlton (England); 142 p.p. $5.00. John Wiley & Sons, Inc.

Covering both theoretical and practical aspects, the new book supplies important methods of analyzing engineering structures with linear load-deflection characteristics with the aid of scale models. The author pays particular attention to the principles of similarity that govern the design of models and by which the results of tests are interpreted for prototypes.

In his discussion of the theory of the indirect model method, Charlton considers the alternative derivations of Muller-Breslau's principle using the principle of virtual work and the Maxwell-Betti reciprocal theorem respectively. The former is emphasized because of its generality and the fact that it indicates the possibility of applying the indirect method for structures with non-linear load-deflection characteristics.

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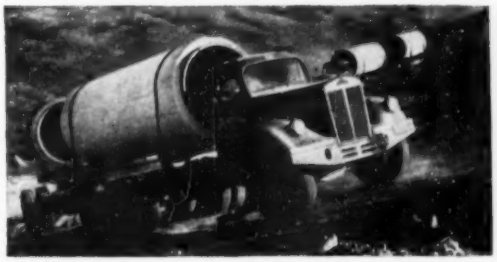

This fleet of ten White six-wheelers with 183 horsepower Mustang Engines is owned by Keith Williams Company, Riverside, California. Rugged, quality features give the Whites more hauling power and greater work capacity under all operating conditions.

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For easy loading and also for load stability, stub axles are mounted on walking beams.

Moving a bulldozer and crane from one small job to another calls for speed and efficient loading—and Rutledge Concrete Company of Richmond finds this Dorsey MTS meets these requirements at least two or three times a day. This trailer carries the machinery to speed the routine of installing septic tanks throughout a wide area served by Rutledge.

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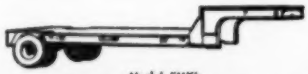

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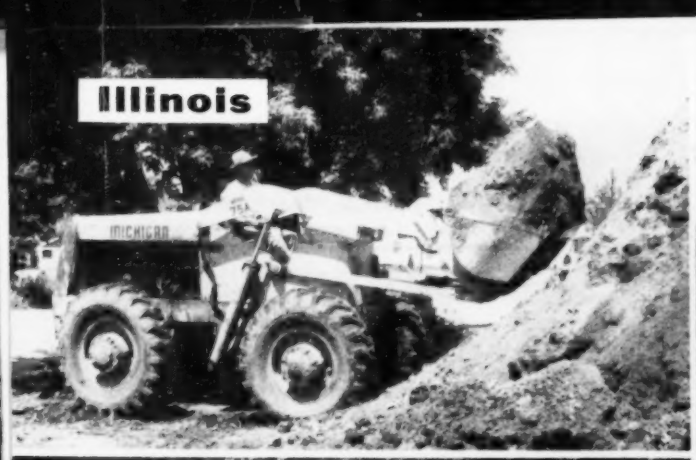

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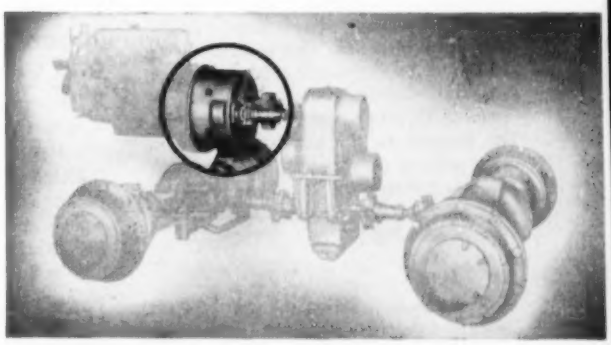

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DIGEST of Current Technical Literature

By JOHN C. BLACK, Associate Editor

Soil stabilization by electro-osmosis

Reduction of soil moisture by electrolytic action is a possibility that could revolutionize stabilization practice. Cases reported in this article cover cofferdams, structural foundations, soft tunneling, and slides. It is only a step to the idea that the method might be applied practically to highway subgrades. Permanent effect is indicated in at least one report.

"If a source of direct current is connected to electrodes that are embedded in saturated fine-grained soil, the following phenomena will occur:

"Pore water will flow toward one of the electrodes, in most soils toward the cathode. This phenomenon is known as *Electro-osmosis.*

"Usually volume decrease will develop in compressible soil. This is accompanied by an increase in bearing value and shearing strength of the soil. This can be called *electroosmotic consolidation.*

"Ions attached to the surface of clay minerals will be exchanged with other ions of like polarity that are present in the pore water or that are carried in by the electric current. This phenomenon is called *base exchange.*

"As a result of electro-chemical decomposition of electrodes, metal salts will be deposited in the pores of colloidal materials, or such salts may react with other free agents that may be present in the pore water or on the surface of the particles. If such reaction results in the cementing of soil particles, it is called *electro-chemical hardening.*"

• • •

"In actual practice, electro-osmosis installations usually are combined with well-point systems. The well points serve as the negative electrodes and, being under suction, carry the collected water to the header pipes, the pump suction, and disposal."

Several successful stabilizations are reported from Europe. Two of them done in 1940. One, a foundation job in silty soil with relatively high ground water was completed without sheet piling in the other, a sliding bank in a railway cut was controlled and has not been reported as giving trouble since. Potentials between electrodes were 90 volts in the one case and 180 in the other. Total energy consumptions were respectively 2 kwh and 1 kwh per cu. yd.

A cofferdam job was saved in soft, silty-clay with a moisture content of 37% and liquid limit of 34%. Potential in this case was 40 volts and energy consumption 0.4 kwh per cu. yd. excavated.

"It is not necessary for unstable plastic soils to be completely dried. . . A small reduction in the moisture content is often sufficient to double the compressive strength of the soil." Specific comparisons are cited.

In the United States the first known application of this method was in 1952 on a power house foundation in Bay City, Mich.

It is admitted that further investigation is needed to develop potentialities and techniques. Both the Army Engineers and the Navy Bureau of Yards and Docks are interested and have done preliminary work.

"Soil Stabilization by Electro-Osmosis" by Fred H. Kravath, Commander, Civil Engineer Corps, United States Navy, THE MILITARY ENGINEER, *The Mills Building, Pennsylvania Ave. at 17th Street N. W., Washington 6, D. C., July-August, 1954.*

Regarding sub-bases and sub-grades

The following quotations present a modern view of requirements for effective slab support.

Other features of Mr. Goldbeck's paper are a review of the past 30 years' developments; a general consideration of slab design and the factors governing it; the author's views on expansion joints, contraction joints, and load-transfer devices; a summary statement on the use of reinforcement; and brief comments on characteristics of concrete.

"Except on a stable, well-drained, granular sub-grade, a suitable blanket course is needed. Such a layer, to prevent mud-pumping, must not contain any appreciable amount of minus 200 material. . .

"The sub-base must be an effective blanket layer which will hold the subgrade in place and prevent the fine particles from filtering upward through that layer. To determine the suitability of such a layer, soils engineers have introduced the term 'piping ratio.' The piping ratio is the ratio of the diameter of the sieve opening which will pass 15 per cent of the filter or blanket, or sub-base material to the sieve opening which will pass 85 per cent of the sub-grade material. This ratio should not exceed 5.0. The theory is that sub-base material coarser than this might allow the subgrade soil to pass or filter upward through it and thus produce a layer of pumpable material immediately under the pavement slab. As a general rule, well-graded concrete sand or stone screenings will meet this piping ratio requirement.

"There is still another matter regarding the sub-base layer. Should it be impermeable or should it allow water to pass through it? Well, personally, I don't like the idea of water filtering down through this layer to the subgrade, for such water will surely make the subgrade softer and less resistant to deformation. On the other hand, the water reaching the sub-base from above should not be trapped there, and that could happen, especially in a trenched type of construction. We shouldn't create an underground lake beneath the pavement. Accordingly, it would seem that a granular sub-base material might well be impervious in its lower level next to the subgrade and more open in its upper half, thus making it drainable and hence less liable to mud-pumping because of its coarseness. This drainable portion of the sub-base could well extend under the shoulders to the side ditches. At least it should be provided with drainage.

"The question of how thick a granular sub-base should be is still not answered. Some engineers have the idea that thickness should be provided to distribute the transmitted pressures and thus increase the load-carrying capacity of the slab by increasing the bearing value of the base or, expressed in terms of the current theory, to increase the Westergaard k value. However, as pointed out previously, a great increase in k or subgrade stiffness does not result in much greater load-carrying capacity of the slab.

"Some engineers have claimed that relatively few inches of sub-base are sufficient to act as a filtering layer to prevent mud-pumping, and if this is true, then a few inches would suffice. It is a fact that severe failure of the Maryland Test Road did not take

place until mud-pumping began. In the case of the Idlewild Airport, three inches of dolomite screenings were tried as a sub-base material, but it was found that this was not enough for, under the action of construction equipment, the sub-base became churned up with the subgrade. When the thickness of screenings was increased to six inches, this churning action did not take place and satisfactory construction resulted. The subgrade was a sandy silt pumped out of the bay, and it could well be that a less favorable subgrade might demand a thicker blanket layer."

"Developments in the Present-Day Rigid Pavement" by A. T. Goldbeck, Engineering Director, National Crushed Stone Association, PROCEEDINGS OF THE THIRTIETH ANNUAL CONVENTION *(March, 1954), Association of Highway Officials of the North Atlantic States, 1035 Parkway Ave., Trenton, N. J.*

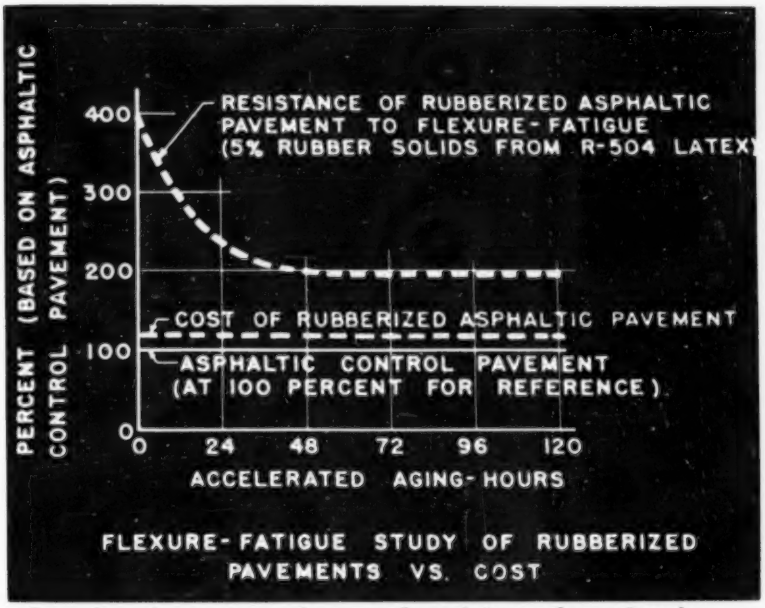
Rubberized asphalt: a summary to date

Though rubber-bituminous paving mixtures are still too new for evaluation by the final test of service, the present aggregate of evidence is highly favorable. This, in spite of occasional ill-advised publicity. The author describes extensive experimental work, completed and in progress, giving special attention to "accelerated aging" tests.

"The chief results which are accomplished with the addition of rubber to bituminous paving mixtures are: (1) a decrease in the susceptibility of the asphalt in the paving mixture to heat and cold, thereby making the pavement less brittle in the winter and preventing bleeding in the summer; (2) a reduction in the brittleness resulting from weathering and aging; (3) the addition of an elastic property to the asphalt which it does not normally have."

The two basic types of rubber — natural and synthetic — their forms, and the methods of combining with asphalt are discussed briefly. Selection of the best combination of materials and methods out of the many possible has been a problem, and to complicate it, "we have found that certain rubbers, or as they technically called 'elastomers,' impart outstanding initial improvements in properties to asphalt which are not retained for long periods of time."

A synthetic latex was used in the studies here reported, the mix consisting of about 5% rubber solids and 95% asphalt. In comparison with straight asphalt, the product is much more viscous, resists flow, and has a definitely observable elastic quality. It permits use of asphalts of higher penetration, without danger of shoving, creeking, bleeding or ravelling.



● Comparison of cost versus resistance to flexure-fatigue under accelerated oven-aging of asphalt paving mixes containing a typical paving asphalt with and without the addition of the synthetic latex compound.

The accompanying graph is one of several used in comparing rubberized asphalt with the non-rubberized product. It is recognized that the accelerated aging effect due to over-heating may not closely duplicate natural aging, but the embrittlement in the asphalt cement binder recovered from the sample indicates that after 48 to 72 hours of this accelerated aging the asphalt was brittle enough so that if the same asphalt were in a pavement the pavement would begin to fail.

Costs used in the graph were for a typical Ohio pavement. Elsewhere they would differ more or less. The curve indicates the increase in cost of the wearing surface only for the pavement in which the rubber has been incorporated. It will be noted that the rubberized paving appears 100% better than the regular asphalt pavement, whereas, the cost is increased only 20%. Considering the entire road construction project, the additional cost is reduced to approximately 3% of the cost of the project.

Fears that the rubberized mixture might stick in the pugmill, or present serious difficulties in laying, proved entirely unfounded.

"Rubberizing Bituminous Pavements," by John R. Moore, Firestone Tire & Rubber Co. Proceedings of the Fifteenth Annual Highway Conference, BULLETIN OF THE UNIVERSITY OF UTAH, *Salt Lake City, July 1954.*

Service manual for small engines

This manual is designed for use by mechanics, service men and others who have a practical working knowledge of the general construction and operation of small engines. It contains necessary specifications and terse procedural data for the repair and maintenance of engines on which the operator may have had no previous experience, covers work from minor maintenance to overhaul.

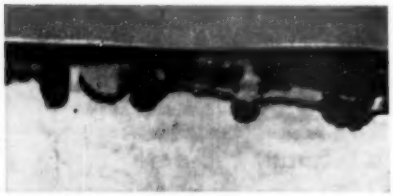
Approximately 150 models of 2 and 4-cycle air-cooled engines of 14 different makes are treated. Horsepowers range from 2 to 36. The material is presented in complete units arranged alphabetically by manufacturers' names. Each unit begins with a tabular listing of engine model numbers and dimensional data (bore, stroke, displacement, etc.). This is followed by a maintenance section covering carburetors, spark plugs, governors, magnetos and lubrication; and finally a repair section.

Along with the maintenance and repair sections devoted to each manufacturer's engines are listed the makes, types and model numbers of such units as carburetors, spark plugs, generators, etc., used on each model. A special feature is a section listing parts numbers for the fast-moving parts for ignition and carburetion systems.

The book is $2.95 per copy.

"Small Engines Service Manual" published by IMPLEMENT & TRACTOR PUBLICATIONS, INC., *Graphic Arts Building, Kansas City 5, Missouri.*

Pellets of Peladow were placed on a cake of ice and their penetration rate was recorded.



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Weather Cycles and Their Causes

By Halbert P. Gillette

Part I

THE weather cycle problem owes its initial difficulty to the large number of cycles. The conflicting effects of many of them, notably the short ones, tend to give an appearance either of non-existence of cycles or of chaos. Adding to this appearance of lawlessness is the fact that in regions not far apart the same cycle often causes opposite effects. For example, it has long been known that heavy rains sometimes occur in Oregon while a serious drought prevails in central and southern California, the reason for which will be given later.

Some time after the writer began his cycle researches in 1926 it occurred to him that it might be wise to give more attention to long climatic than to short weather cycles. Geological strata often show the repetition of a long cycle of seemingly uniform length. For example a series of paired beds of black shale and white shale, about 4.5 ft. thick per pair, often occur, as shown in Fig. 1. When the writer was a student of geology such a series of beds was supposed to record changes in the level of the sea in which the sediments were deposited. His professor of geology, John Newberry, taught that theory, and himself had proven the cyclic origin of certain systems of strata of great thickness by showing their repetitive character both in thickness and in kinds of rock. He stressed the evidence of the rise and fall of the earth's crust, but, in that connection, did not say anything as to the evidence of climatic changes recorded in the strata.

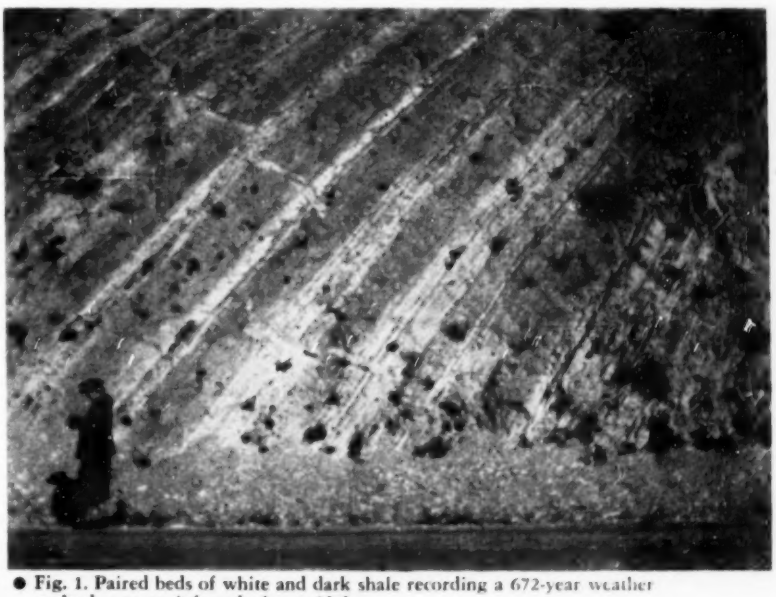
Climatic Cycles Recognized

However, other research geologists had subsequently stressed the evidence of climatic alternation between wet and dry phases. In a very wet phase of a long, strong cycle, rivers delivered great amounts of sand to the sea, and strong currents, due to the strong winds at such times, had spread the sand over large areas of sea bottom. During the succeeding dry, warm phase of the same cycle, dissolved limestone in the river water floating on the sea was precipitated; for it was held in solution by the carbon dioxide that the river water had absorbed from the air until the sun's heat caused some of it to evaporate, whereupon the white calcium carbonate was precipitated. Fig. 1 shows clearly such an alternation of the two opposite phases of a climatic cycle nearly 700 years long. In this case the cool phase of the cycle was mainly recorded by dark colored mud; the warm phase by light colored mud containing white calcium carbonate.

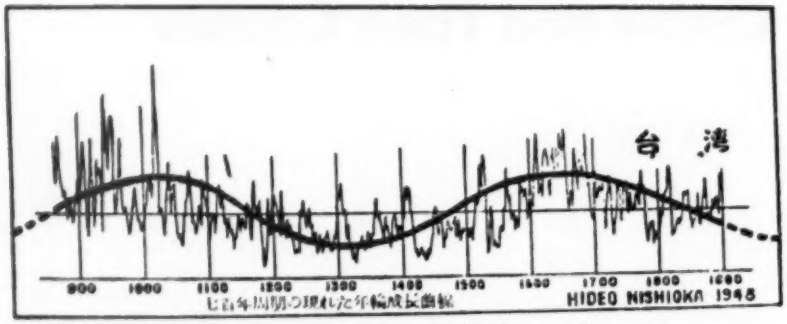
In Newberry's day it was not known that the length of such a cycle could be determined with considerable accuracy. Yet as early as 1769 a Swedish military engineer, C. F. Nordenskiold, had published a scientific paper suggesting that the thin layers of clay (¼ in. or so thick), so common in brick yard deposits, had been deposited in "still water" by rivers during spring floods. He did not know that the "still waters" had been ancient glacial lakes that were so abundant in Sweden during the last Ice Age; for it was not till 1840 that Louis Agassiz of Switzerland published evidence supporting his Ice Age theory. Incidentally, geologists were so skeptical that it took Agassiz about a generation to convince them, which he did by piling up evidence that thick sheets of ice had covered great areas of northern Europe and North America. Because he was unable satisfactorily to explain the cause of such a phenomenon, geologists, astronomers and meteorologists first turned deaf ears toward Agassiz. His own former geological teacher, one Braun, wrote him: "Stick to your fishes, Agassiz", which he did, while also sticking to his Ice Age theory.

There were three Ice Ages in the Quaternary Age, each being the cold, wet phase of a cycle of about 160,000 years, as indicated by the writer's investigations. Short subcycles of the Ice-Age cycle have enabled the writer to find that the last Ice Age had its maximum or "peak" about 20,500 B.C. At that time the vast ice sheet had its terminus on Long Island, in southern Illinois and along the Missouri River, as shown spectacularly by great morainal deposits. The vast ice-sheets of Greenland and Antarctica still bear witness to Ice Age cycles of the Quaternary Age.

Rock varves in the writer's collection often contain a very thin white lamina that is calcarious, and was evidently precipitated by the evap-



● **Fig. 1. Paired beds of white and dark shale recording a 672-year weather cycle due to an inferred planet Alpha.**



● Fig. 2. Graph of Formosa tree ring thickness by decades recording a 672-year rainfall cycle due to an inferred planet Alpha.

oration of carbon dioxide by the summer heat. Rock varves commonly average 10 to 14 to the inch. Those in the 32 pairs of beds, of which 9 pairs are shown in Fig 1, average about 150 to the foot; and since these pairs of beds average about 4.5 feet thick, this cycle's length was about 675 years.

Fortunately a tree ring cycle of the same length records the same cycle beautifully, as shown in Fig. 2. The thicknesses of these rings by decades are plotted in that graph, and a curved line drawn to indicate their mean thickness. These Formosa rings were measured by a Japanese researcher, Prof. Hideo Nishioka of Keio University in Tokyo, and published in his book in 1949. The first American translation of parts of that book was published in the Nov. 1951, issue of Cycles, New York City. Nishioka regards the cycle as about 700 years long, but his graph itself indicates a length considerably less, with its last dry maximum about 1325 A.D.

The writer discovered evidence of this cycle in varved rock strata as shown in Fig. 1 which was published in 1940. Shortly afterward similar series of paired rock beds were found in many places along our Pacific Coast from northern Washington to southern California in Tertiary strata.

The most striking displays of climatic cycles geologically recorded are in regions where nearly horizontal strata have been deeply eroded. Grand Canyon, Colorado, is over a mile deep, and from its rim one can see many long series of strata of the same thickness either containing, or superimposed on, a series of beds of very different but uniform thickness. Field glasses of course aid greatly in recognizing that ratios of 3 to 1 in thickness are most outstanding, hence, that as to long climatic cycles there is evidence that their lengths were probably harmonic. This led the writer to infer that some short cycles might also be harmonic. It seemed to him significant that the orbital period of Venus (0.615 yr.) and Mars (1.-881 yr.) have a ratio very nearly as 1 to 3; and that the same is true as to Saturn (29.458), Uranus (84.013) and Pluto (248.43). Then it became obvious that the cycle of 672 years recorded in Figs. 1 and 2 is very nearly 8 times the orbital period of Uranus.

This led to an investigation that resulted in Table I where the 672-year cycle is inferred to be caused by a giant planet, yet to be seen, designated as Alpha.

Sunspot Studies

The first column gives orbital periods of the 9 largest planets. The most outstanding cycle in sunspot numbers, often called "the sunspot cycle" as if there were no other, is one of about 11 years. Its discovery was announced in 1843 by S. H. Schwabe, a German apothecary who had spent 18 years daily recording the number of visible spots. Astronomers paid scant attention to this important discovery for 8 years, until, in his great Kosmos, Humboldt spoke approvingly of it!

An average length assigned to it by seven researchers recently was 11.17 years. But a far more accurate determination of its length is had by analyzing the thickness of annual tree rings for 30 centuries and Lake Saki, Crimea, annual varves for 40 centuries, for emission of electrons from sunspots tends to cause rainfall. In this way the writer found its length to be 11.20 years both in California and Crimea. Thus the writer in 1930 found also a harmonic cycle of 22.40 years that is doubtless associated with Hale's cycle of magnet polarity of sunspots.

Astronomers commonly believe that the length of the Schwabe cycle varies considerably. But the writer has found that whenever a noteworthy variation from intervals of 11.2 years occurs between sunspot maxima, it has been caused by the effects of strong cycles caused by planets.

The writer believes that the cause of the 22.4 year sunspot and rainfall cycle is the regular rotation of a deep seated magnetic solar core in 22.4 years. At 11.2-year intervals when a magnetic pole of that core is the 290 degrees longitude of a siderially fixed stream of ions (electrified corpuscles) a very great number of sunspots is generated. Great spiralling streams of ions, cohering magnetically because of their velocity, are then evidently emitted by the sun and magnetically attracted by the Earth and other planets.

There is cycle evidence of 12 siderially fixed streams of solar ions constantly emitted from the sun. The most powerful of these ionostreams is in heliocentric (sun-centered) longitude 290 degrees; and the others are at 30 degrees intervals. When a planet crosses the stream in 290 degrees, its reactive effect causing spots on the sun is greatest, and is less when it crosses the other streams. In fact when it crosses the stream in 110 degrees, there is a diminution in the number of sunspots, as is strikingly shown in Table II.

The writer calculated this table in 1940 by averaging the number of sunspots for each calendar day for 50 years. The mean number on July 12 is 52.8 which is the maximum. The Earth's heliocentric longitude then is

Table I
Harmony of Original Orbital Periods

Planet	*Present Period*	*Original Period*	*Difference Percent*
Mercury	0.241		
Venus	0.615	$1/36 \times 22.4 =$ 0.622	1.2
Earth	1.000	1.000	0.0
Mars	1.881	$1/12 \times 22.4 =$ 1.867	0.8
Jupiter	11.862	$\frac{1}{2} \times 22.4 =$ 11.200	5.9
Saturn	29.458	$2\frac{1}{2} \times 11.2 =$ 28.000	5.2
Uranus	84.013	$3 \times 28.0 =$ 84.000	0.0
Neptune	164.793	$2 \times 84.0 =$ 168.000	1.9
Pluto	248.430	$3 \times 84.0 =$ 252.000	1.4
Alpha	672.000	$8 \times 84.0 =$ 672.000	0.0

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Means
1	38.8	39.7	39.2	39.9	44.3	39.5	41.7	38.4	40.6	39.1	39.3	40.6	40.1
2	37.4	40.0	37.9	41.3	45.0	41.9	42.6	42.4	37.8	41.2	38.6	40.7	40.6
3	34.4	39.2	39.6	41.3	43.7	41.8	43.2	43.6	39.7	40.5	39.9	40.6	40.6
4	35.3	39.2	39.7	41.6	44.7	39.8	41.9	42.2	37.9	39.5	38.2	39.4	40.0
5	36.2	40.8	40.5	40.8	41.5	39.7	42.3	46.1	39.6	40.9	38.8	37.5	40.4
6	34.5	42.4	41.3	40.9	40.6	40.4	42.6	47.4	40.2	41.7	39.1	35.4	40.5
7	35.8	41.3	41.8	41.5	40.6	40.3	44.8	47.1	40.2	43.7	37.0	35.7	40.8
8	34.3	39.6	44.3	39.1	42.3	39.5	48.2	47.2	41.0	46.2	37.8	37.0	41.4
9	33.6	42.6	45.2	40.4	41.4	37.5	49.4	45.9	41.7	45.0	37.1	36.2	41.3
10	33.6	44.2	43.4	39.0	40.8	38.5	50.2	49.5	40.8	45.6	40.5	38.1	42.0
11	33.8	45.6	41.9	37.7	38.6	36.8	51.2	46.3	40.4	45.7	38.5	39.7	41.4
12	33.6	46.2	40.5	38.3	39.7	35.7	52.8	47.4	42.0	44.8	43.9	41.4	42.2
13	33.4	46.2	37.6	36.5	39.3	39.2	51.1	47.5	41.5	44.5	43.3	43.6	41.9
14	36.6	45.3	35.6	36.0	38.8	39.9	48.2	46.4	39.5	42.3	41.4	40.1	40.8
15	38.0	44.0	36.6	34.3	39.3	40.6	49.4	45.3	40.5	39.8	40.3	41.8	40.8
16	43.6	41.9	37.6	33.2	38.7	41.9	47.6	45.0	37.5	37.6	39.6	40.9	40.4
17	41.1	39.9	36.9	30.3	37.4	43.9	45.6	41.8	36.3	36.6	37.0	41.6	39.0
18	39.4	37.4	35.6	28.8	37.9	41.6	41.8	42.0	38.3	36.1	39.0	42.3	38.4
19	39.6	38.2	36.3	30.4	38.6	44.2	42.4	39.2	37.6	35.5	37.7	40.8	38.4
20	38.4	38.2	35.5	30.4	37.5	43.9	43.5	37.9	38.7	36.4	38.1	37.8	38.0
21	39.0	39.2	36.6	33.7	37.6	44.4	43.6	39.3	38.3	38.7	38.6	40.4	39.1
22	39.7	40.0	37.0	35.1	39.9	45.2	44.1	37.0	39.9	38.3	38.2	40.3	39.6
23	40.7	39.3	35.5	36.1	40.0	46.8	43.6	38.4	42.1	40.0	38.4	41.2	40.2
24	42.2	41.3	35.2	35.3	43.5	43.7	43.3	35.9	43.7	39.5	40.0	43.3	41.6
25	43.0	40.3	36.4	38.7	42.2	45.7	44.1	36.3	44.0	41.4	42.7	43.0	41.6
26	41.6	42.3	35.6	39.8	41.5	44.9	42.1	36.2	45.6	38.1	40.1	44.3	41.0
27	41.7	42.6	34.1	38.8	42.2	45.1	40.1	36.5	45.7	39.1	40.0	44.0	40.6
28	39.5	40.5	34.0	40.1	43.4	45.0	38.1	37.9	45.7	41.6	42.0	40.3	40.7
29	38.9		35.2	38.9	40.0	44.8	39.6	39.0	45.5	38.3	41.0	39.6	40.1
30	37.6		35.3	41.2	38.8	44.7	36.6	39.5	42.1	38.2	39.2	40.0	39.4
31	37.8		35.3		38.6		38.0	40.3		39.4		39.3	—
Tot.	1173.1	1127.4	1177.2	1119.4	1257.9	1256.9	1373.7	1304.9	1224.2	1255.3	1185.3	1216.9	—
Mean	37.8	40.3	38.0	37.3	40.6	41.9	44.3	42.1	40.8	40.5	39.5	39.3	40.2

● Table 2. Daily sunspot means of 50 years. (1889-1938).

290 degrees; but when it is 110 degrees on January 10, the number is a minimum of 33.6. Hence the peak of this 12-month sunspot cycle is 57% higher than the valley! This table was printed (October, 1954) in the Bulletin of the American Meteorological Society as part of a contribution on "Evidence of a Precipitation and Sunspot Cycle of One Month." In the writer's opinion, this cycle of one month is due to the Earth's crossing siderially fixed solar ionostreams at 30 degree intervals, but the editor of the Bulletin thought that the theory would not interest many meteorologists, so it was omitted.

Since the Earth is farthest from the sun July 6, the 12-month sunspot cycle peak July 12 obviously is not due to the eccentricity of its orbit. Consideration of other factors showed only one that could explain this cycle, namely that the sun travels orbitally toward the very bright star Vega whose longitude is about 285 degrees. Vega's latitude is about 60 degrees North. The direction of the sun's motion has been determined approximately by several astronomers by the shift of the spectroscopic lines of many stars, toward the violet for those toward which the sun travels, toward the red for those in the opposite direction. At first it was not evident how the sun's orbital motion could cause an increase in the number of sunspots when the Earth's longitude is near that of Vega the "apex of the sun's way." But since there is evidence that "cosmic dust" pervades all space, it seemed to the writer likely that such dust contains ions charged with electrons. If so, the relative motion of the sun through them would induce magnetism in the sun, thus charging the sun with electrons. That would result in discharges of electrons, which, because of the sun's magnetism, would tend to occur in definite directions geometrically located with respect to the direction of the sun's motion. The densest charge probably would occur on the front of the sun facing Vega, or in 290 degrees, whence the strongest electron discharge would occur. In accordance with a principle discovered experimentally by Faraday in 1821, the magnetic field of the sun would cause the emitted electrons to advance spirally; and, moving at high velocity, they would attract one another magnetically with great force. Thus solar electron streams are caused to cohere and maintain great density at prodigeous distances from the sun.

To this Faraday principle, the writer attributes not only the rotation of sunspots but terrestrical cyclonic and anticyclonic whirls. Each whirl thus generated has magnetic polarity, as is well shown by the fact that when sunspots are most numerous in the sun's southern hemisphere there is an abnormal influx of solar electrons into the ocean and the crust every 24 hours when our north magnetic pole and the sun are in the same longitude. This explains also the remarkable 24-hour cycle in pressure registered by the barometer.

Meteorologists Criticized

Meteorologists have been singularly averse to electric and magnetic theories, partly as a consequence of which meteorology is perhaps the least progressive of all the sciences.

Commenting on its slow advance, a celebrated English astronomer, Sir John Herschel, said in 1845:

"Do we call for facts? They are poured upon us in such profusion as for a time to overwhelm us, like the Roman maid who sank under the load of wealth she had called down upon herself. Witness the piles of unreduced meteorological observations which load our shelves and archives. What we now want is *thought*, steadily directed to single objects."

Nearly 110 years after those words were printed, we still lack *thought*, adequate *research thought by meteorologists* as to weather cycles and their causes. Even the most useful data for such purposes remain unpublished in meteorological magazines and books, e.g., the Douglass' tables of tree ring measurements and Schostakowitch's table of Lake Saki varve thicknesses that have no break back for more than 40 centuries. Contrast the relative unimportance of our Weather Bureau's statistical records that go back only a slight fraction of the oldest tree ring dates. A Weather Bureau official recently published an article to indicate the importance of the "22-year" sunspot and rainfall cycle in which he said:

"What we know about the weather of the past is an index to the weather of the future. Year by year we add to this knowledge. A few of our weather records run back into the first quarter of the 19th century, but these records are mostly in the East. It was not until 1886 that we had a sufficient number of (Weather Bureau) observers around the country to give a reliable picture of the national rainfall."

But not a word did he say about existing tree ring measurements in many regions, or the desirability of more in other regions. Of course he made no mention of varves, for they are geological phenomena supposedly outside the realm of meteorology.

Coming back to Table II and its evidence that when the Earth's longitude is 290 degrees there tends to be an annual maximum of sunspots, that discovery led to a search for evidence that other planets cause a similar effect. This was found to be the case as to the other three small "inner" planets, Mercury, Venus and Mars. Then to test this theory as to the four giant planets, Jupiter, Saturn, Uranus and Neptune, tree ring and varve thicknesses were tabulated in a way that would disclose a rainfall cycle whose length between maxima is that of the planets orbital period in years.

To do this the American Ephemeris (published annually by the Govt. Printing Office) was consulted to find when a planet was last in heliocentric longitude 290 degrees. By subtracting integral multiples of its orbital period from such a date, the years in which a planet was previously in 290 degrees were deduced. These dates were entered in the first column of a table. In the second column was entered the thickness of a tree ring that year, followed by the thickness for each successive year; e.g., for 12 years in the case of Jupiter, and 30 in the case of Saturn. Every column was totaled, and the annual mean thickness deduced. The mean of the thicknesses in the initial column is thickest, if enough repetitions of the cycle have been tabulated to "iron out" the effects of other cycles and occasional phase inversions of the given cycle.

Such a tabulation has not only the merit of extreme accuracy where the data cover many repetitions of the cycle, but it discloses harmonic subcycles, notably one of 1/12 the length of the orbital period, e.g., 7 years in the case of the Uranus period of 84 years. Alternate peaks of the 7 year cycle often are higher.

Similarly the inferred planet Alpha was found to have caused a harmonic subcycle 56 years long, or 1/12 of 672 years, thus confirming the inference that it is a planet. Even stronger evidence that it is a planet was found by the occurrence of peaks of tree ring and lake varve thicknesses when it was calculated to have been in heliocentric conjunction with each of the four giant planets. The mean length of any conjunction cycle is determined by dividing the two orbital periods by their difference. In the case of Uranus and Alpha, the conjunction period is 96 years, which both tree rings and lake varves disclose. It has great amplitude (departure from a mean) on its peak dates. Its last peak would have been in 1946, if the orbits of both Uranus and Alpha were exact circles. In 1947 the greatest number of sunspots were recorded since 1749 when Wolf's monthly numbers begin.

In Part II of this article, which will be published in a forthcoming issue, a table will be given of length and a peak date of each of 10 weather cycles due to the four giant planets and Alpha, the inferred giant whose heliocentric longitude is now near 88 degrees, and its latitude probably near the ecliptic plane which the other giants hug.

Alpha, it should be added, was in 290 degrees in 1658 A.D.; and, aided by another inferred giant planet (Beta) of 3 times Alpha's orbital period, caused what certain English researchers call "The Little Ice Age," which lasted some 50 years. That was a period when sunspots were abnormally few; which the writer attributes either to great discharge of solar ions that obscured the spots, or else they were beneath the sun's surface. The climax of The Little Ice Age came in January 1658 when the Baltic Sea between Sweden and Denmark froze so thick that Swedish Cavalry crossed on the ice, surprised the Danish forces and conquered them.

Such freezes of that sea have been very rare, and near times when volcanic eruptions were frequent. These, as well as earthquakes, are probably due to movements of the Earth's crust caused by magnetic forces induced by abnormally strong streams of solar electrons. This theory, and evidence supporting it, will be present in the third article of this series. In that article the genesis of the planets and their satellites by solar ions will be considered.

Accurate Forecasts

Since the primary object of weather cycle research is accurate forecasting, it is fitting that a definite forecast be made as to the time when the series of recent severe droughts will reach a climax of severity. Alpha is their basic cause, although other cycles due to the four known giant planets are mainly accountable for important oscillations. Since Alpha's last wet maximum was in 1658, its next dry minimum will occur 336 (or ½ of 672) years later, or 1994 A.D., 40 years hence. Of course there will not then be an end of the series of short droughts, for they will continue for many years though with decreasing severity.

The Columbia River flow has been decreasing since the early 80's and the Nisqually Glacier on Mt. Rainier, Washington, has certainly been retreating at least since 1857, and probably since 1658 when the "Little Ice Age" had its crest. Fig. 2 shows that the Formosa tree rings had maximum thickness remarkably close to the "Little Ice Age" maximum cold and minimum of visible sunspots.

There has been much published speculation as to when "normal weather" will return, also frequent denials by supposed meteorological authorities that any outstanding cycle has been affecting the weather. Let them tell us now what the Formosa tree ring curve means if not a weather cycle of about 670 years.

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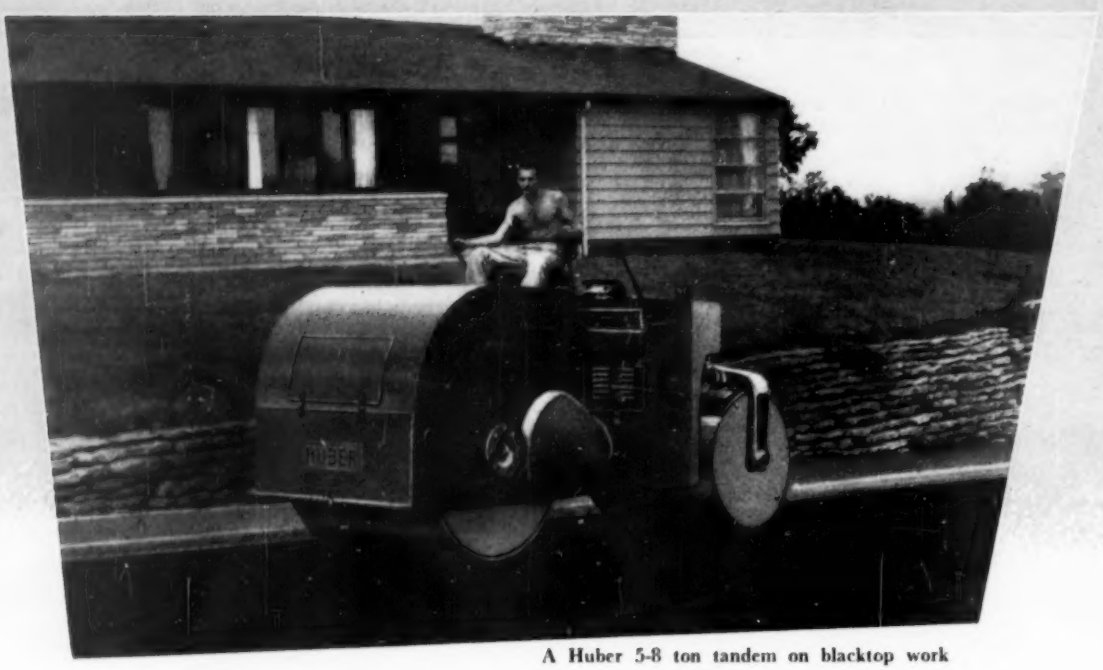

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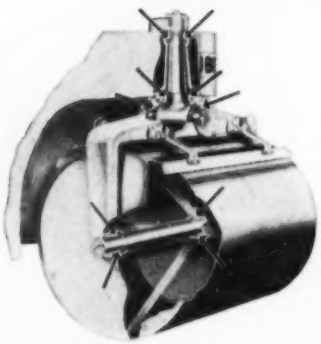

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VIEWS AND COMMENTS

By H. G. Newitt

Flexible Surfaces Must Be Flexible

THE first requirement for a bituminous surface — and, for that matter, any surface of the flexible type — is to possess flexibility. We have pointed out the need for attention to fundamentals in a previous issue. Numerous examples indicate that this one — rather intangible, and therefore rarely given direct consideration — deserves priority. Perhaps one reason for this priority is that the exact properties of a flexible surface are rarely discussed, and perhaps are not widely understood.

Just what is a flexible surfacing or road structure? While simple to describe, its properties are quite interesting and involve extremely complex physical phenomena. Such structures must meet apparently conflicting demands, yet they do so continually. A flexible surface must of course carry the load without failure. That is, it must not deform within itself, such as through rutting or shoving; it must transmit the load to the base below; and it must perform its part in the resistence of the structure as a unit. Likewise it must conform to the base on which it lies despite movements of the latter due to compaction, volume changes or other reasons.

This means that the surface structure at times must make incremental adjustments on each load application, while meeting the previously stated requirements. Yet this adjustment must not continue beyond the point where base support is again available and meets design requirements.

● Summing up, it is a surface which is neither rigid nor plastic. Rigid slabs break when base support is lost, rather than adjust to it. This makes them very vulnerable to base changes from settlement, moisture variations, and the like, as our present large program of resurfacing this type of structure indicates. A plastic surface is almost as unsatisfactory. It will adjust to the base, but keep moving after this point has been reached. This continued flow within the pavement itself is something quite different from the incremental adjustments to maintain base support characteristic of properly functioning flexible surface.

In these apparently contradictory properties of the flexible type lie great advantages. Always obtaining the full support of its base, it has a lesser demand for thickness. Of course the overall design must suit, as there is a limit to the load-carrying ability of the surface. This brings out another advantage of the type, namely, that failure does not occur in the adjusting period. If the movement tends to continue beyond full base contact because the base itself is insufficient and is deforming, there is time for correction by providing additional strength. This leads to the third advantage, which is that the structure can be built up in small increments. With reasonable care to avoid obvious planes on which slipping might occur, to prime the previous surface and so on, the resulting thickened mat is quite satisfactory.

Of course the final story is told by an economic comparison made objectively and fairly; for in types, as in prices, competition is the life of trade. Rigid slabs properly designed to take care of the loading despite the eventualities to be expected in the way of settlement, moisture effects and other factors make extremely satisfactory roads. The bituminous surface must be in like manner correctly designed. Both designs must be realistic and practical in their approach; and both must offer equal — and satisfactory — service, because they otherwise involve high maintenance costs. Yet when this is done and the design is adequate, such costs are quite low for both. Unfortunately too many examples of insufficient design in both types are to be seen.

It seems almost unnecessary to point out that all the advantages pertaining to the flexible type pavement are lost if it is so constructed that it acts as a rigid slab regardless of intentions to the contrary: it functions poorly as such. Rigid slabs can be made using bituminous cements, but the specifications for the latter would be quite different than those for usual highway asphalt. Mats lacking flexibility are liable to disintegrate when sufficient base settlement causes cracking of the surface. Sometimes these cracks will heal and the surface still function, but there is strong possibility that this healing will not occur. Even when it does, the mat is rarely a satisfactory example of a bituminous surface, tending to be rough, to ravel or to break out and to have other troubles, such as those resulting from water infiltration. If we are going to build a flexible surface we should make sure it is obtained.

● How rigid surfaces result from a supposedly flexible design is of course a fair question. The most common cause is from insufficient asphalt in a mat which would otherwise be suitable. This insufficiency may exist at the time of the original construction, or may appear later from undue reduction of the binder film thickness by loss of volatiles or by absorption of the asphalt or some fraction thereof. Most bituminous engineers fear the presence of excessive asphalt because of the immediate problems which result. We cannot criticize this attitude — certainly mats with asphalt in excess after loss of volatiles, absorption, moisture removal or similar, are undesirable and should be avoided. However, if this is allowed to dominate the design and the mats always tend to be on the lean side, a worse problem results. For the ultimate penalties from insufficient asphalt are liable to be even greater; yet this is often not realized because of the deceptive circumstances usually surrounding this condition initially.

The other source of mats which in due course do not function as truly flexible surfaces is an unsuitable mix design. The most common cause of such unsuitability is lack of room for sufficient asphalt to give flexible films. Extremely well balanced gradings, permitting the presence of very little filler, or the use of excessive filler in ordinary gradings will bring about this situation.

The next type of unsuitable mat is that resulting from the presence of unduly hard bitumen in the films. This can come about either because the binder was incorrectly selected for the conditions or was lacking in quality and hardened rapidly in use. It can also result from a poorly designed mat which fails to protect the

(Continued on page 82)

● Gulf Bitulithic Company's 4,000-lb. Madsen hot-mix asphalt plant.

Methods and Costs on 29 Mile Hot-Mix Face Lifting Job

By E. O. Beatie

The Texas Company

THE widening and resurfacing of 29.7 miles of old concrete pavement on Texas State Highway 6 in Brazos and Grimes Counties required 140,000 tons of hot-mix asphaltic concrete. This work was completed in March, 1954, under two contracts by the Gulf Bitulithic Company of Houston, for District 17 of the Texas Highway Department.

Traffic on Route 6, which was uninterrupted by the work, averages 3,000 vehicles a day, including much heavy motor freight.

Total costs of these projects were reduced appreciably by the use of local sandstone in the hot-mix asphalt leveling courses, placed at about $.24 per sq. yd. per inch thickness or about $.08 per sq. yd. less than the average cost.

Brazos County Project

Under a contract in Brazos County, 18.9 miles of 20-ft. by 9-6-9 concrete pavement, south from the city of College Station, was widened 2½ ft. on each side with hot mix before receiving a 5-in. asphaltic concrete resurfacing.

● *Widening Operations.* Prior to widening, the pavement first received a preliminary leveling course of Texas Type B modified hot-mix (all aggregate passing 1-in. screen). The mix was placed by a blade maintainer at a rate of 200 lb. per sq. yd. to give a compacted thickness of about 2 in. and rolled with pneumatic, three-wheel and tandem rollers in the order named.

For each side of the existing pavement a widening trench was cut by the blade approximately 5 ft. wide to a depth of 3 in. below the bottom edge of the slab.

The trench was filled with four layers of Texas Type A modified hot mix (all aggregate passing 2-in. screen), so that the final elevation of compacted mix was even with the first leveling course already placed on the old pavement. The first layer of mix in the trench was placed with an

● Trench cut by motor grader preparatory to widening.

● Placing fourth layer of hot-mix using an Apsco trench widener.

● Compacting final hot-mix layer with Apsco trench roller.

Apsco trench widener to a width of 3½ ft. Successive layers were narrowed about 3 in. each by adjustment of the machine, so that the fourth and final trench layer was 2½ ft. in width. This gave an outside sloping edge to the hot-mix widening, as a means of spreading traffic loads. Each layer was compacted by an Apsco trench roller, and the final layer was finished with an 8-ton tandem roller.

These operations thus resulted in a new 25-ft. width and a 14-in. depth of hot mix in the widening trenches. The sloping edge of the hot-mix was backfilled with the dirt excavation and the shoulders and slopes dressed.

● *Leveling Courses for Resurfacing.* Type B modified hot-mix for the second leveling course was then placed in windrow down the center of the highway, by means of the trench widener. The windrow was knocked down by the blade and spread to a width of 24½ ft. Compaction was accomplished by the pneumatic roller, following closely behind the blade, and later by a 10-ton three-wheel and 8-ton tandem rollers. Application rate was again 200 lb. per sq. yd. to give another compacted thickness of about 2 in. or a total of about 4 in. of leveling.

● *Surface Course.* Texas Type D hot-mix (all aggregate passing ½-in. screen) was then placed in two 12-ft. lanes by a Barber-Greene finisher at a rate of 100 lb. per sq. yd. to give a 1-in. compacted surface course 24 ft. wide. Rolling was done by the 10-ton three-wheel roller followed by the 8-ton tandem. The surface course width was made 3 in. less on each side than the previously placed 24½ ft. leveling course, the difference being backfilled with earth. This stepped edge construction was specified to reduce edge failure and help secure proper density when rolling the edges.

In the finished 24-ft. pavement, total resurfacing or overlay thickness of the old 9-6-9 concrete pavement was approximately 5 in. In the widening trenches, the total thickness of hot-mix was about 17 in.

Grimes County Project

Under a contract in Grimes County, 10.8 miles of old 18-ft. by 9-6-9 concrete pavement, from Navasota to the Waller County line, was widened on each side with 6 ft. width of crushed stone flexible base placed 8 in. thick over a 4-in. compacted sand cushion. The pavement had received in the past a premix asphalt resurfacing of about 1-in. thickness.

Two leveling courses of Type B modified hot-mix, the first 25-ft. and the second 24½-ft. in width, were placed at an application rate of 200 lb. per sq. yd. each in order to give a total compacted thickness of about 4 in. These were followed by a 1-in. compacted surface course of Type D hot-mix placed in two 12-ft. lanes to give a final riding surface of 24-ft. width. Placement methods were identical with those employed for the Brazos County contract. Salvaged select material was used in the shoulder work.

Total new resurfacing or overlay thickness for the old pavement and the flexible base was approximately 5 in.

● *The Hot Mix.* For both the Brazos and Grimes contracts the aggregate for hot-mix widening and leveling courses consisted of locally available crushed sandstone. Imported gravel and fines from the sandstone pit were employed in the Type D surface course. Specified maximum for the Los Angeles Abrasion on Type D aggregates was 40. No abrasion test was required on the sandstone aggregate.

For quality control of the hot-mix, density and modified Hveem Stability determinations were made. Approximate asphalt contents and the grade employed for the three hot-mix types were as tabulated.

The low specific gravity of the sandstone aggregate accounted for the higher than average asphalt contents in the widening and leveling courses.

A tack coat consisting of 0.03 gal. per sq. yd. of RC-2 was placed on the old pavement and between all hot-mix courses. Grimes County also used a RC-2 tack coat of 0.1 gal. on the flexible base widening for a width of 4 ft.

● *Costs.* The Brazos County contract totaled $503,134.25 for all work; the Grimes County job, $347,318.93. Unit bid prices on hot-mix items were as follows:

Item	Unit Bid Price Per Ton	
	Brazos County	Grimes County
Aggregate Type A Modified	$ 3.67	$ ——
Aggregate Type B Modified	3.36	3.50
Aggregate Type D	4.50	4.70
Asphalt	23.00	25.54
Tack Coat	.15 per gal.	.20 per gal.

● *Personnel.* Texas Highway Department personnel responsible for this work were John E. Blair, district engineer, District 17; O. L. Crain, assistant district engineer; J. M. McLain, resident engineer for the Brazos County Project; and J. M. Graham, senior resident engineer for the Grimes County Project.

Personnel for the Gulf Bitulithic Company were E. B. Cape, president; A. J. Dudley, superintendent; Sam Kelley, road foreman.

Type of Mix		Asphalt Grade	Percent Asphalt by Weight Total Mix Basis	
			Brazos	Grimes
A modified	Widening	Texaco 135-Penetration	6.0-6.5	—
B modified	Level-Up	Texaco 135-Penetration	6.0	6.0
D	Surface	Texaco 90-Penetration	5.0-5.3	5.0

● Maintainer spreads windrow for second leveling course.

● Leveling courses rolled by rubber-tired, 3-wheel and tandem rollers.

● Type D surface put down by Barber-Greene spreader.

● Close-up of new paver on Chicago's Lake Shore Drive.

● Rollers used on the job.

New bituminous paver gets tryout in Chicago

On Chicago's heavily travelled Lake Shore Drive, a northern bottleneck near the Edgewater Beach Hotel was eliminated by late season bituminous construction in November.

Helping to meet the paving deadline was a new bituminous finishing machine developed by Blaw-Knox, placed experimentally on the job. The new paver which is capable of laying a 12-ft. lane at a rate of 50 to 55 ft. per min. was watched with interest by visiting firemen.

In placing both binder and surface courses, this pneumatic-tired and highly maneuverable bituminous paver is reported to have met the rigid mechanical and pavement standards of the Cook County highway department, agency responsible for extension of the drive from Bryn Mawr to Hollywood. The contractor is Standard Paving Co.

Flexible surfaces

(Continued from page 79)

bituminous film; an example is unnecessary porosity, permitting excessive exposure of the bituminous films to the hardening effects of air and water throughout the mat.

Finally, and rarely recognized, are mats unsuitable due to the use of aggregate types and gradations which result in aggregate interlock such as to make flexible adjustment of the surface difficult or practically impossible. We have commented on this point before. Since such mats are extremely easy to build, and function very well as long as there is sufficient base support to require negligible adjustment in the mat, they are often striven for rather than avoided.

● In our view, every design needs checking to make sure that this fundamental of flexibility is met. Some of the above sources of difficulty are obvious, but others are not too readily noted unless specifically looked for. The real criterion is the result on the road. It seems doubtful that there is a good laboratory test widely used today which clearly brings out this lack of flexibility. Some tests do indicate the situation, at least from certain of the above sources. The flow test in the Marshall technique, excessive stability in the unconfined compression test, offer typical warning signs. However, we are not sure the property of flexibility is actually measured by these tests. We feel that a study of this property and how to control it is in order. But we also think that the engineer in the field can tell rather quickly whether he is building a mat which lacks flexibility; and we suspect that, at least to a trained eye, inspection of laboratory samples will probably also indicate this at an early stage in the design.

● We hope that we will find agreement that mats which are supposed to be flexible sometimes are not; and likewise, that some of the causes of this lack are not always obvious. Yet the profession cannot afford, for many reasons, to fail to correctly build this type of road when it is called for. The advantages are too great, the future of our highway system (particularly in the medium and low cost fields), too much dependent upon the outstanding properties of flexible surfaces to have these surfaces at times in default. Fortunately the cure in our opinion is simple — nothing more than common sense. The engineer must continually inspect and consider what he is building. Because most of the sources of unduly hard mats are evident to the man who knows this line of work if he has had sufficient practical experience to recognize the troubles which bring about this undesirable condition. Every job should be suspect from this standpoint, regardless of its apparent conformity to design or procedure standards; this is the responsibility of the builder.

ASTM issues new bituminous standards

ASTM standards of bituminous materials for highway construction, waterproofing, and roofing (with related information), 448 pages, 6 x 9, heavy paper cover. $4.00.

The September, 1954, edition of this compilation brings together in compact, readily usable form 110 ASTM standards, including 62 test methods; 42 specifications; 4 definitions of terms relating respectively to bituminous waterproofing and roofing materials, materials for roads and pavements, specific gravity, and timber preservatives; and 2 recommended practices: one for accelerated weathering test of bituminous materials, and one for bituminous mixing plant inspection.

Subjects included are standards covering creosote materials of direct interest in highway construction which are under the jurisdiction of Committee D-7 on Wood.

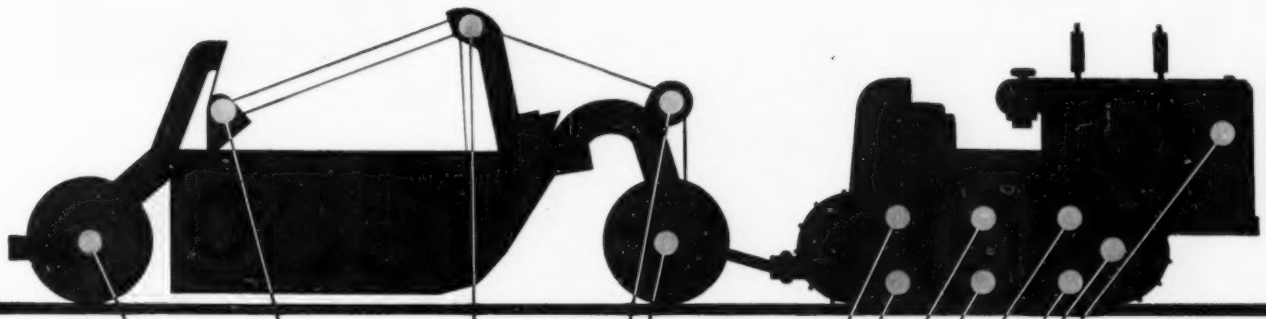
Test methods and specifications cover: highway construction materials; water-proofing and roofing materials (such as asphalts, coal-tar pitch, fabrics, felts, shingles, and creosote); also viscosity by means of the Saybolt Viscosimeter; volume correction tables, and many others.

New material includes test methods for: asphalt insulating siding surfaced with mineral granules; staining properties of asphalts (modified pressure method); Saybolt Furol viscosity of asphaltic materials at high temperatures; and specifications for bituminous saturated woven burlap fabrics.

Appendix I in the book reviews cooperative studies of a stripping test for bitumenaggregate mixtures. An easily usable table of contents is included (by subject and ASTM serial designation).

Copies can be obtained from Headquarters, American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

now 1 grease replaces 7



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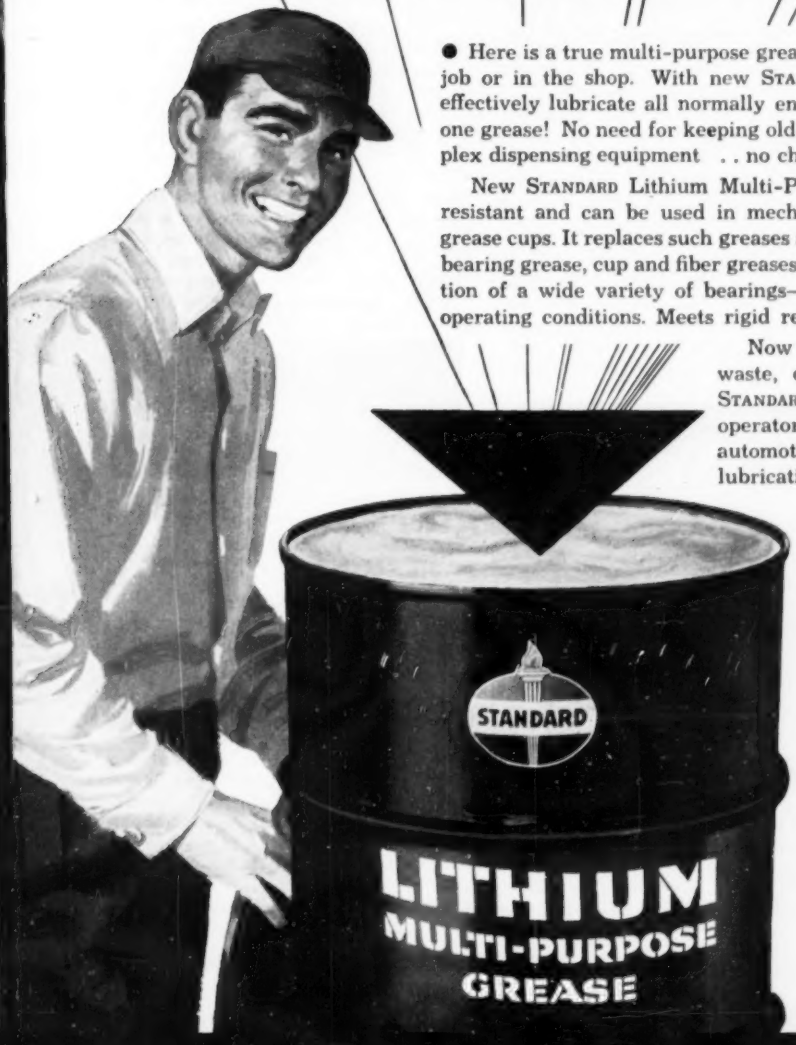

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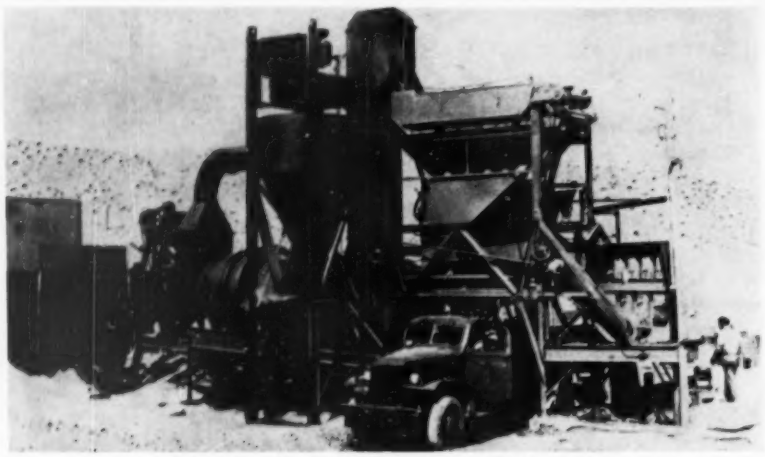
What's New
in Equipment and Materials

Reader Service Coupon on Page 16, more items pages 58-61



Standard Portable Asphalt Plant in Operating Position

Mobile Batch Type Asphalt Plant

A new Model TM portable asphalt plant, announced by Standard Steel Corporation, 3001 S. Boyle Ave., Los Angeles 58, Calif., is a complete batch-type plant. It is designed for use in areas where larger plants cannot be erected and operated profitably, and where portability is an important factor. The welded steel framework is heavily braced to withstand corrosion and stress in transit. All undue vibration is eliminated, greatly reducing maintenance time and costs. The entire unit is mounted on heavy-duty pneumatic truck tires. Tractor type trailer hitch and air connections permit the unit to be moved with a semi-type truck tractor. The chassis and running gear are specially designed to provide maximum strength and with minimum maintenance.

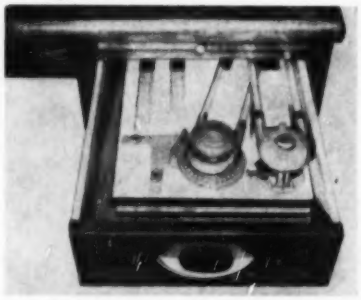
Ease of erection is one of the important features claimed for the new plant. Equipped with its own exclusive self-erecting device, the entire cage, consisting of vibrating screen, mixing unit, aggregate weight hopper and asphalt bucket, is raised into position merely by pushing a button. Total time for this operation is stated to be a maximum of 30 minutes. The power-hoist is run by a ⅝ hp worm gear motor that requires no more current than a light bulb. Important features claimed for the Model TM plant include the following: it is completely portable for transportation anywhere, economically; the exclusive "self-lift" erection device and compact design greatly accelerate erection and dismantling; unusually large capacity for a portable plant expands its usability; accurate gradation control and batch-type operation allows exact specification work.

For more information circle 120 on Service Coupon Page 16 and mail now.

Personal Drafting System

Universal Drafting Machine Corp., 7960 Lorain Ave., Cleveland, O., is now in production on a portable drafting system of professional quality for personal use. It is stated this new layout tool will permit construction men to draft plan changes right on the job — to save time and costly errors — and will facilitate all kinds of plot plan, appraisal drawings.

Universal desk-topper drafting and layout machine consists of a newly designed drafting machine with a drawing capacity of 22 in. x 34 in., a 9 in. and a 15 in. engine-divided aluminum alloy scale, a folding board equipped with folding legs and rubber feet that, when opened, accommodates drawings up to 17 in. x 22 in., a box for instruments, a tracing paper dispenser, and a carrying carton or custom styled travel case.



Desk-Topper Machine in Office Desk Drawer

For more information circle 121 on Service Coupon Page 16 and mail now.

One-Ton Roller

Illustrated here is the new Model 125 Motoroller manufactured by Gabb Special Products, Windsor Locks, Conn. This new one-ton roller, which was introduced

Model 125 Motoroller

in the spring of this year, supplements the line of general utility rollers which the company has been manufacturing since 1949. The company states that acceptance of the new roller by contractors has been very encouraging and that it has proved very useful for compacting driveways, parking areas and other bituminous surfaces. The manufacturer also advises that several contractors have found this roller excellent for "sealing" larger hot top surfaces, prior to compaction by their 3 to 5 ton rollers. It has a weight range of 1500 lb. dry to 2500 lb. with water ballast. It is powered by an 8 hp Briggs & Stratton engine.

For more information circle 122 on Service Coupon Page 16 and mail now.

Longer Conveyor for Eagle Loader

To meet the need for a longer, higher conveyor on its truck-mounted loader, Eagle Crusher Co., Galion, O., has made available a 15 ft. powered conveyor which can now be raised or lowered hydraulically. The advantages claimed are that the discharged material can be more accurately placed on the dump truck and will reach higher trucks. The greater length on the conveyor is particularly useful, too, where the truck being loaded travels directly ahead of the Eagle Loader. The extra length conveyor and the hydraulic control are both optional features at slight extra costs.

Eagle Truck-Mounted Loader with 15 Ft. Powered Conveyor

For more information circle 123 on Service Coupon Page 16 and mail now.

15 KW AC Electric Plant

A new 15 KW gasoline-powered AC electric plant has been put into production by Kohler Co., Kohler, Wis. Available in six different models with remote control or stand-by starting, and with varying voltage outputs, the new plant is water cooled with a large radiator, belt-driven centrifugal pump and blower fan. It features an adjustable jet carburetor with automatic choke and a mechanical fuel pump with oil bath air filter. A carburetor and valve kit for converting the fuel supply to natural or artificial gas is available. The six cylinder engine pro-

Shown is the Model 848 Intermediate Plant. There is a Barber-Greene Plant to meet the needs of every user, for every capacity, for every type of mix.

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MIX profitably.

MIX more tonnage per season. **MIX** to meet all specifications.

MIX continuously, with the principle that is inherently automatic.

MIX with mechanically interlocked proportioning for the utmost uniformity.

MIX with the plant that is truly portable.

Let us show you how a Barber-Greene Plant can reduce your costs.

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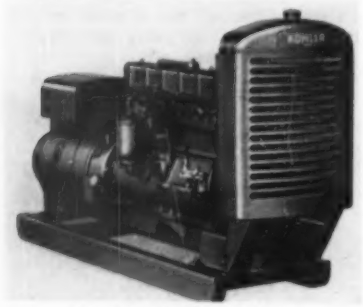
descriptive literature . . . sound movies

cost studies . . . nearby job inspection . . . plant layouts

. . . for more details circle 167, page 16

duces 51 hp at 1800 rpm and has a 3½ in. bore and 3¾ in. stroke.



New Kohler Electric Plant

For more information circle 124 on Service Coupon Page 16 and mail now.

Steam Cleaners for Construction Equipment

A new line of Hypressure Jenny steam cleaners, known as Series "1800," has been announced by Homestead Valve Manufacturing Co., Corapolis, Pa.

Each of the nine models in the line features 180 gal. per hour steam cleaning capacity for removing heavy deposits of grease and dirt from machinery, equipment, trucks, parts, etc. Two of the models are available with finger-tip control of flushing and rinsing capacity up to 480 gal. per hour.

Designed especially for extra-heavy duty cleaning jobs, and for either single gun or two gun operation, the Series "1800" Jennys offer a choice of oil-fired or gas-fired units in either stationary or portable type. For field use, or anywhere that electric current is not available, units are offered with gasoline engine drive in place of electric motor.

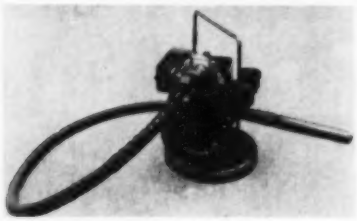
Series "1800" Hypressure Jenny

For more information circle 125 on Service Coupon Page 16 and mail now.

Light Weight High Speed Vibrator

A new, light-weight, high-speed concrete vibrator is being produced by the Stow Manufacturing Co., 609 Shear St., Binghamton, N. Y. Mounted on a light-weight base, the JB vibrator can be easily carried around on the job. This machine vibrates at from 6000 to 9300 vibrations per minute and has a 2 HP, 4 cycle, air-cooled engine. It has a ball bearing eccentric belt tensioner and a special spring lock for fastening the flexible shaft to the countershaft.

The JB vibrator is furnished with the same size flexible shafting (⅞ in. dia.) as larger machines. The standard equipment includes one Model 1600 (1⅝ x 10 in.) vibrator head. It can also be furnished with heads in sizes 2 in. x 10 in. or 2½ in. x 10 in. Different combinations of 7 ft., 14 ft., or 21 ft. flexible shafts can be furnished to give total lengths up to 35 ft. The vibrator head can be removed and attachments screwed on for either wet or dry grinding of concrete.



Stow JB Vibrator

For more information circle 126 on Service Coupon Page 16 and mail now.

Torque Wrench Weighs 8½ Lb.

A new light weight Size 4, Type "F" torque wrench has been introduced by Richmont, Inc., 922 S. Myrtle Ave., Monrovia, Calif. This improved tool, sold

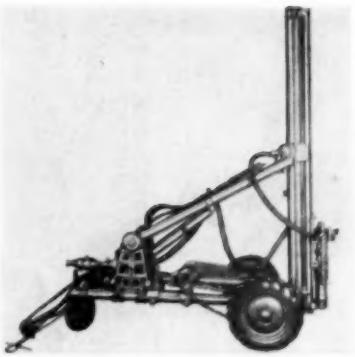
"Tru-Torq" Wrench

under the trade name "Tru-Torq," has a capacity of 4800 inch-pounds, (model 6 SD 4800) or from 100 to 500 foot pounds (model 6 SD 500). Its streamlined design and lighter weight (8½ lb.) is stated to make the Tru Torq Size 4 wrench fast and easy to use for diesel engine overhaul, bridge construction, high line steel towers, railroad repair work, reinforced steel construction, oil field equipment maintenance, earth moving equipment maintenance, etc.

For more information circle 127 on Service Coupon Page 16 and mail now.

Self-Propelled Wagon Drill

The addition of a Cleveland air motor and special axle, to make its Cleveland DR-30 wagon drill self-propelled, has been announced by Cleveland Rock Drill Division of LeRoi Co., 12500 Berea Road, Cleveland 11, O. The Cleveland



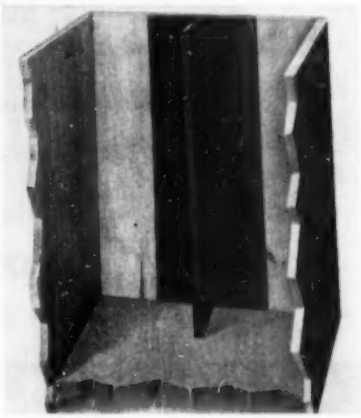
Cleveland DR-30 Wagon Drill

air motor, with its gear ratio, has plenty of power for propulsion over rough terrain. A similar air motor is also used for raising and lowering the wagon-drill boom and further speeds the drilling operation. Power is transmitted from motor to wheels by a chain drive. Though this is shown exposed in the view above, it is actually fully enclosed. Wheels are mounted on an automotive-type axle. Patented air feed has an 8 ft. travel for 6 ft. steel changes.

For more information circle 128 on Service Coupon Page 16 and mail now.

Split Type Water Stop for Easier Installation

A new split type dumbbell rubber waterstop which eliminates the need for slotting or split-bulkheading when forming structures or walls where hydrostatic water pressure is involved, has been introduced by Servicised Products Corporation, 6051 W. 65th St., Chicago, Ill. Split type waterstop is supplied with one-half of the width split so that it may be fastened or nailed to the inside of the bulkhead in such a manner as to form



Split Type Dumbbell Waterstop

a "T." This eliminates the necessity of slotting or splitting the bulkhead saving time and labor and insuring greater forming material savings. After the section has been poured, the bulkhead is stripped and the two divided sections are joined together with rubber cement or by stapling.

For more information circle 129 on Service Coupon Page 16 and mail now.

● Land clearing tractor and electric tree saw, two of the new R. G. LeTourneau, Inc., equipment items.

R. G. LeTourneau makes progress in new fields

In the year since R. G. LeTourneau, Inc., sold its earthmoving business to Westinghouse Airbrake, it has reorganized and launched many new products.

As announced by R. L. LeTourneau, vice-president in charge of sales, the company has introduced an entirely new packaged power system for heavy equipment, the Electric Wheel; opened a new field for contracting by marketing a fast-cutting, self-propelled tree saw and a companion land clearing tractor; produced large-capacity revolving cranes and jackknife cranes for transporting as well as lifting multiton cargoes; developed the rubber-tired, trackless LeTourneau Train for transport of cargo and passengers across rough and unimproved terrain; designed the LeTourneau Transporter in several models applicable to the logging and overseas development fields; and designed the LeTourneau Off-Shore Drilling Platform, a movable platform with electro-mechanically raised and lowered legs for use in water up to 100 feet deep.

In the industrial and materials handling fields, LeTorneau is manufacturing and selling electric hoists and jib cranes, electric motors, generators and generator sets. At the company's Vicksburg, Miss., plant, development is being pushed on diesel-electric marine equipment. LeTourneau is expanding its manufacturing facilities at both Longview and Vicksburg.

LeTourneau is looking to land clearing as one of the first large markets for its new machinery. The company claims that for the first time land clearing operators have the equipment that makes it a specialized and profitable branch of contracting. To demonstrate the speed and utility of the new machinery, the company contracted a 16,000-acre land clearing job for a government dam and flood control reservoir.

USE SWENSON SPREADERS FOR ICE CONTROL

Spreads Salt 200 Lbs. per Mile!
Spreads Narrow Strip or Full Traffic Lane

Spreads all materials. Salt, cinders, sand, calcium chloride, rock chips, etc. Adjustable to spread any desired quantity in any width from a narrow strip to a full traffic lane.

Write for Complete Information

SWENSON SPREADER & MFG. CO.
LINDENWOOD, ILLINOIS

. . . for more details circle 213, page 16

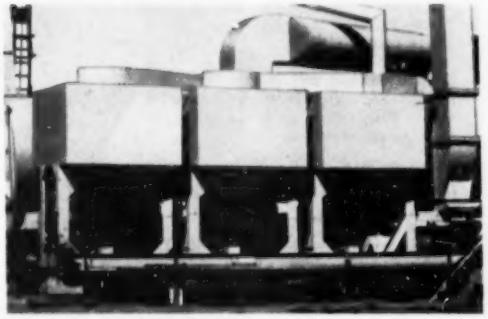
YOUR ASPHALT MIXING PLANT

will be more efficient with a

MADSEN DUST COLLECTOR UNIT

MADSEN *Equipment that Serves*

MADSEN "On-The-Square" Dust Collector Units (Patent No. 2,678,110) give you the ultimate in efficiency in cyclonic and labyrinth concentration principles of dust collection. They're designed for use with either batch or continuous type asphalt plants and are available in one, two and three cyclone units. Some of the outstanding MADSEN features are shown below . . . check them and see why MADSEN Dust Collectors lead the field.



OUTSTANDING FEATURES

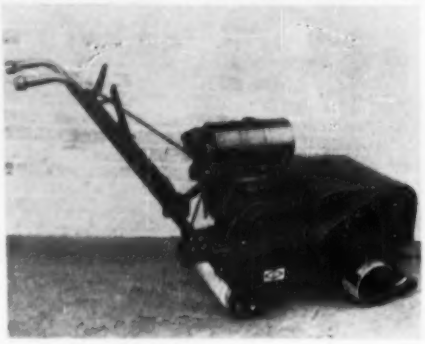
- Complete portability: Entire unit is mounted on base frame for easy handling on transport wheels.
- All-welded design reduces air intrusion to a minimum.
- Sets up faster.
- 90% of surface, including ducts and piping, is made with flat A.-R. steel plate. This eliminates the need for specially-formed sections when repairs are needed.
- Low overall height for easier maintenance and transportation.

JUST OFF THE PRESS: Catalog No. 123 describing the complete line of MADSEN Dust Collector Units. Write for your copy today.

MADSEN IRON WORKS, INC.
14100 E. ROSECRANS AVE., P. O. BOX 38
LA MIRADA, CALIFORNIA

. . . for more details circle 197, page 16

LUCAS
ASPHALT COMPACTOR



Eliminates Hand Tamping

This portable, precision-built compactor is used for tamping and rolling asphalt close to walls, light poles, traffic signals and in all inaccessible places . . . and for use on all types of asphalt patching and repairing jobs.

WE WANT DEALERS

Terms Can Be Arranged

Contractors, See Your Nearest Dealer, Or Write

LUCAS ASPHALT COMPACTOR COMPANY

2209 E. Market St. Stockton, Calif.

. . . for more details circle 196, page 16

White Heating Kettles Have Fire-Proof Tops

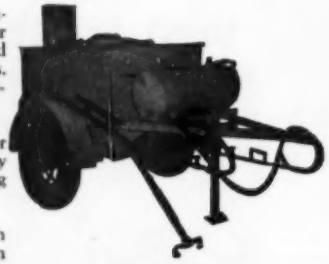
Cut-back and highly inflammable road repair material can be heated safely in White kettles. FIRE-PROOF top reduces fire hazard.

White asphalt and tar kettles are extensively used. They give long life and satisfaction.

Plain kettles or with hand or engine driven spray pumps for patching pavement. Thermometer, barrel hoist, warming hood extra. All oil burning. Semi-elliptic springs, pneumatic tires.

65, 110, 165, 220, 300 gallon capacities.

Model F-10 is oil jacketed, to heat elastic joint filler.



Other Products

CONCRETE VIBRATORS
Gasoline Engine and Electric Motor Driven Models

ASPHALT PLANTS
Portable — Stationary

FRONT END LOADERS
for Industrial Tractors

KEROSENE TORCHES
3 to 20 gal. Capacities

Write for Circulars

Elkhart, 20 White Mfg. Co. Indiana

. . . for more details circle 217, page 16

down by the seashore

TATEM Surf Club

Carefree living enhanced by . . . large, cheerful guest rooms . . . private pool, ocean beach, cabana club . . . dining room and cocktail lounge.

Selected Clientele

Write for Booklet

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A BIG
Miami Beach
VACATION AT LITTLE COST!
Stay as long as you like

$ from 6

Rates without meals from $2.50 per person double occ.

- Swimming pool
- Private beach
- Continuous entertainment
- Beach parties • Dancing
- Weenie roasts
- Water shows
- Gifts for Honeymooners

PER PERSON PER DAY
DOUBLE OCCUPANCY
INCLUDING MEALS
(Breakfast and Dinner)

FREE PARKING
Send for color folder

AIR CONDITIONED
Atlantic Towers
HOTEL • POOL AND CABANA CLUB

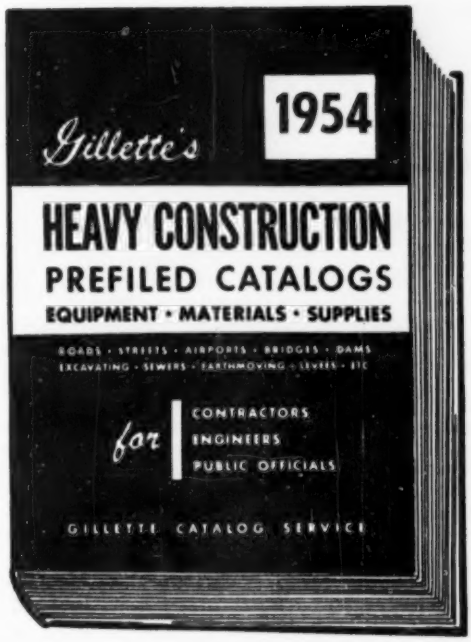
DIRECTLY ON THE OCEAN AT 42nd ST.

here . . . without a doubt . . . is the most useful buying catalog in your office

. . . and here are some reasons why you should be USING IT DAILY!

- Catalogs are PREFILED — saving you time and space required to file individual manufacturers' catalogs.
- Saves you the time and inconvenience of writing to manufacturers for catalogs.
- Gives you all the facts needed BEFORE you make a buying decision.
- Manufacturers' names and trade names indexed alphabetically for quick reference to individual catalogs.
- All the buying information is 'boiled down' — designed for your convenience.

After checking the advantages listed above, you can see why this ONE CATALOG offers you so MANY advantages . . . saving you both time and money, not only in the mechanical and physical aspects of a cataloging operation . . . BUT MOST IMPORTANT OF ALL . . . it is available WHEN you NEED it . . . BEFORE you make your buying decisions! The manufacturers represented in this catalog are literally 'meeting' with you in your office — offering you all the information you could possibly need concerning their products. Why not meet them at least half way — and USE THEIR PREFILED INFORMATION!



Here are the manufacturers represented in Gillette's Heavy Construction Prefiled Catalog:

Allis-Chalmers
All Purpose Spreader Company
American Air Filter Company, Inc.
American Bosch Corporation
American Brake Shoe Co.
American-Coleman Co., The
American Manganese Steel Division
American-Marietta Company
American Steel & Wire
American Tractor Equipment Corp.
Anthony Company
Armco Drainage & Metal Products, Inc.
Austin-Western Company
Badger Machine Co.
Baldwin-Lima-Hamilton Corporation
Baker-Lull Corp., The
Ballard Inc., C. L.
Barber-Greene
Bicknell Manufacturing Company
Briscoe & Son, E. V.
Bros Boiler & Mfg. Company, Wm.
Buda Company, The
Buffalo-Springfield
Butler Bin Company
Carey Manufacturing Company, The Philip
Chausse Mfg. Company, Inc.
Chrysler Industrial and Marine Engine Corporation.
Clark Equipment Company
Cleaver-Brooks Company
Cleveland Trencher Co., The
Clyde Iron Works, Inc.
Concrete Surfacing Machinery Co., The
Continental Motors Corporation
Cummer & Son Company, The F. D.
Cummins Engine Company, Inc.
Dann Diesel Corporation
Detroit Diesel Engine Division
Dorsey Trailers
Electric Tamper & Equipment Co.
Erie Steel Construction Company
Felker Manufacturing Co.
Fiske Brothers Refining Co.
Flexible Road Joint Machine Company, The
Flintkote Company, The
Gallion Iron Works & Mfg. Company, The
Gar-Bro Manufacturing Co.
Gar Wood Industries, Inc.
General Excavator Co.
General Motors
Gledhill Road Machinery Company, The
Goodall Rubber Company
Greenville Steel Car Co.
H & L Tooth Co.
Harnischfeger Corporation
Heil Co., The
Heltzel Steel Form & Iron Company, The
Hercules Motors Corporation
Herman Nelson Division
Hough Co., The Frank G.
Ingersoll-Rand
International Vibration Company, The
Jackson Vibrators, Inc.
Jones & Laughlin Steel Corporation
Jay Manufacturing Company
Katolight Corporation
Keystone Asphalt Products Company
Kiesler Co., Joe E.
La Crosse Trailer Corporation
Laughlin Co., The Thomas
Le Roi Company
Littleford Bros., Inc.
Lubriplate Division
Madsen Iron Works, Inc.
Marlow Pumps
Minneapolis-Moline
Motter Printing Press Co., John C.
Naugatuck Chemical Division
Noble Company
OK Machinery Division
Omaha Standard
Osgood-General
Owen Bucket Co., The
Pacific Car and Foundry Company
Pioneer Engineering Works, Inc.
Poor & Company
Porter, Inc., H. K.
Prehy Company
Republic Steel Corporation
Rogers Brothers Corporation
St. Paul Hydraulic Hoist
Seaman Motors, Inc.
Servicised Products Corporation
Shunk Manufacturing Company
Sterling Engineering & Manufacturing Co.
Stow Manufacturing Company
Sumner Equipment Limited
Symons Clamp & Manufacturing Company
Tarrant Mfg. Co.
Tilden Tool Mfg. Co.
Timken Roller Bearing Company, The
Toncan Culvert
Transport Trailers, Inc.
United States Motors Corporation
United States Rubber Co.
United States Steel
Wellman Engineering Company, The
Winpower Manufacturing Co.
Wix Corporation
Wyoming Valley Equipment Co., Inc.
York Modern Corporation

Manufacturers' Literature

Trailer Tool Box

A new fully illustrated 4-page bulletin describing the new Tool-Master, the all steel, tamper-proof, weatherproof tool trailer with over 30 cu. ft. of storage space and a 2000 lb. load capacity, is announced by Aeroil Products Co., Inc., 42 Wesley St., South Hackensack, N. J. Features of the recently introduced Tool-Master are thoroughly detailed, including battery operated blinker lights, side work shelves, sliding tool tray and the ability of the unit to trail easily behind passenger cars and light pick-ups. The new brochure also explains the Tool-Master's bolt-on-chassis, a design innovation, which allows the unit to be used in two places at once.

For more information circle 130 on Service Coupon Page 16 and mail now.

This is Blaw-Knox

The diversified manufacturing activities of the Blaw-Knox Co., Farmers Bank Building, Pittsburgh 30, Pa., are shown in a recently published 50-page informational brochure entitled "This is Blaw-Knox." It contains illustrated material on all major departmental operations in the company's eleven divisions: Blaw-Knox Equipment, Buflovak, Chemical Plants, Foote Construction, Lewis Machinery, National Alloy, Power Piping and Sprinkler Rolls, and Union Steel Castings. Chief emphasis is placed upon products and services and their industrial applications. Other features include the location and manufacturing facilities of company plants, and a complete listing of available catalogs.

For more information circle 131 on Service Coupon Page 16 and mail now.

Motor Grader

Adams motor grader No. 550, powered by 115 H. P. diesel engine, is described in a new highly-illustrated catalog released by the manufacturer. The catalog covers the construction of the machine, its operating advantages and shows the machine's application to a wide variety of work. Copies may be had by writing J. D. Adams Manufacturing Co., Indianapolis 6, Ind.

For more information circle 132 on Service Coupon Page 16 and mail now.

Portable Reinforcing Rod Fabricator

The new Iron Man, a portable reinforcing rod fabricator, is illustrated and described in a 4-page circular issued by Acme Equipment, Inc., Central Trust Building, Altoona, Pa. This is stated to be the only equipment in the construction field, combining automatic rod bending and shearing in a single, compact, versatile unit. It is designed for fast on-the-job work, for easy portability from job to job, and for maximum precision output at low cost. The bending apparatus and shear of the Iron Man is actuated by powerful 3¾ in. hydraulic rams. It is stated that the Iron Man can bend as much as six tons of large reinforcing bars in an hour. The Iron Man cold works concrete reinforcing bars in all sizes from ¼ in. up. It also works smooth surface bars (such an anchor bolts) flats, angles and pipe.

For more information circle 133 on Service Coupon Page 16 and mail now.

Truck Crane

A new bulletin, TX-159, on the P&H Model 105 TC truck crane is now available from Harnischfeger Corporation, 4610 West National Ave., Milwaukee 46, Wis. Offered as a big brother to the P&H Multi-Mite, the Model 105 TC is available only on its own precision-built carrier. It is rated at a full 10-ton crane capacity, and is easily converted to all other services, handling standard buckets at efficient boom lengths. For scrap yard service, the 105 TC swings a big 39-in. magnet. This machine is built with the rugged P&H powerbox upper that carries all driving machinery in a single, sealed transmission running in oil. Complete details on the P&H carrier are also included, along with illustrations of the 105 TC at work on a variety of jobs.

For more information circle 134 on Service Coupon Page 16 and mail now.

Reflective Coating Sign Kits

A new catalog sheet on Cataflex high intensity reflective coating kits has been released by Cataphote Corporation, 958 Wall St., Toledo 10, O. The kits provide an inexpensive, easy-to-use method for quality reflectorizing of highway warnings, street signs, and lettering and danger markings on truck bodies.

For more information circle 135 on Service Coupon Page 16 and mail now.

Portable Powered Core Drills

A new bulletin 21 describing its line of LD and LLD portable powered core drills has been issued by Acker Drill Co., 725 W. Lackawanna Ave., Scranton, Pa. The Model LD combines into a compact unit standard power plant, a powerful built-in cathead hoist, a built-in positive displacement pump, a three-speed transmission and a rugged rotary drill with hand lever feed. The Model LLD is a lightweight unit without a pump, hoist or three-speed transmission but with the same rugged rotary drill head. Either model is an easily transported compact core drill suitable for highway test cores, soil sampling, coal and mineral prospecting, etc.

For more information circle 136 on Service Coupon Page 16 and mail now.

Crane Has Many Uses

An 8-page illustrated bulletin (AD-2253) describing its indoor-outdoor hydraulic crane has been issued by Austin-Western Co., 601 Farnsworth Ave., Aurora, Ill. Included with specifications and performance data are diagrams on working ranges, manual boom extensions, minimum aisle widths for turns, etc. Also described are attachments and special equipment.

For more information circle 137 on Service Coupon Page 16 and mail now.

Applications for Gradall

The first of a new series of application bulletins to show contractors the wide variety of jobs the multi-purpose Gradall handles in various fields of construction work has been issued by the Gradall Division of The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, O. This bulletin utilizes the photograph-story technique with the 31 different construction job pictures appearing in this first issue. In the field of general contracting, the new bulletin shows pictures with descriptive captions on such jobs as excavating, grading and lifting. One photograph shows a crawler Gradall at work in very tight quarters digging a water line trench beneath an overpass. This is typical of Gradall work inside buildings and tunnels and under low wires.

There are also photographs showing Gradalls at work uncovering pipe lines, digging basements and placements for footers, as well as handling sloping, grading and back-filling jobs. Other photographs show Gradall machines in highway construction work such as ditching, road widening, road repair and new highway construction.

For more information circle 138 on Service Coupon Page 16 and mail now.

Highway Ice Control

Manual IM-1 "Calcium Chloride for Ice Control," available from the Calcium Chloride Institute, 909 Ring Building, Washington 6, D. C., includes recommended procedures for treating and storing abrasives and spreading them for most effective winter maintenance operations. It includes information on direct application of calcium chloride as well as recommended procedures for mixing with different types of abrasives. Other data included consist of charts and tables on skid tests, melting action of treated abrasives, and specifications.

For more information circle 139 on Service Coupon Page 16 and mail now.

Power Units

A 6-page brochure announces the new power giant power units offered by Willys Motors, Inc. Complete specifications of engines, standard equipment and housing are given. Includes horsepower, torque and fuel consumption figures of 4 and 6 cylinder power giant engines. Brochures are available by writing Industrial Engine Department, Willys Motors, Inc., 975 N. Cove Blvd., Toledo, O.

For more information circle 140 on Service Coupon Page 16 and mail now.

Reflective Traffic Paints

New catalog literature on Cataline premix compound and Cataline Beads-on Paint Compound (Drop-On) has been released by Cataphote Corporation, 958

Wall St., Toledo 10, O. This literature is fully descriptive of the traffic paints offered by the company and includes such information as application data, drying time, units of sale, and prices per gallon. The sheet on Cataline Permix Compound includes a full page of information including preparation, operating tips, and shutting down of application equipment.

For more information circle 141 on Service Coupon Page 16 and mail now.

Portable Powered Soil Sampling Rigs

A new bulletin (No. 29) on its Models RGT and RG portable powered soil sampling rigs has been issued by Acker Drill Co., Inc., 725 W. Lackawanna Drive, Scranton, Pa. Both models feature a powerful hoisting winch for jetting and driving pipe or piles. A lever controlled positive displacement pump is also included on either model. Power plant can be either gasoline, kerosene, diesel, electric or air motor or direct power take-off from a motor truck. A special feature of these portable, relatively inexpensive rigs is that a rotary drill head can be added at any time in the future. With the drill head added, the unit — in addition to soil sampling — can be used for rock coring and foundation test boring.

For more information circle 142 on Service Coupon Page 16 and mail now.

Snow Plows for Graders and Tractors

A new bulletin (No. 1060) Baker snow plows for Allis-Chalmers motor graders and industrial wheel tractors has been announced by The Baker Manufacturing Co., Springfield, Ill. The bulletin gives complete specifications for all Baker snow plows for all models of the Allis-Chalmers motor grader and industrial wheel tractor line, along with design and performance characteristics for each. Details such as the type of lift on the snow plows available for the Allis-Chalmers line — hand hydraulic, power hydraulic, scarifier, or mechanical; along with wing extensions and section tripping blade design; are all covered in Bulletin 1060.

For more information circle 143 on Service Coupon Page 16 and mail now.

Servicing Engine Cooling Systems

A useful 16-page service bulletin (No. 19) for the cooling systems of internal combustion engines has been issued by Cummins Engine Co., Inc., Columbus, Ind. It contains many practical suggestions on the best way to care for an engine's cooling system. The information is not only for Cummins diesels, but applies to all internal combustion engines.

For more information circle 144 on Service Coupon Page 16 and mail now.

Self-Priming Centrifugal Pumps

A new bulletin (No. W-395-B2) on self-priming centrifugal pumps, available from Advertising and Sales Promotion Department, Worthington Corporation, Harrison, N. J., explains graphically the specifications, applications and sizes of various types. The bulletin presents information on component parts, characteristics, ranges of application and a comprehensive chart of the pump models listing their dimensions in inches. The pumps are frame mounted with capacities to 550 gpm, heads to 140 ft. and sizes from 1½ to 4 in.

For more information circle 145 on Service Coupon Page 16 and mail now.

Bucyrus-Erie Complete Line Described

A new edition of Bucyrus-Erie's general catalog (GC-5A), describing the company's complete line of excavating, drilling and material handling equipment, has been released. Designed for quick reading the 70-page, 2-color catalog features concise copy, condensed specifications and over 100 photo-illustrations of Bucyrus-Erie machines on specific jobs. Several recent additions to the company's line of products are included in sections entitled — Quarry and Mine Shovels (2¾ to 8 cu. yd.) and Blast Hole Drills; Stripping Shovels (18 to 36 cu. yd.); Walking Draglines (4 to 30 cu. yd.); and Railway Cranes (including a 250-ton diesel-electric crane). The GC-5A catalog can be obtained by writing Bucyrus-Erie Co., South Milwaukee, Wis.

For more information circle 146 on Service Coupon Page 16 and mail now.

(Continued on page 104)

For me it's

LITTLEFORD "SPRAY MASTER"

WITH THE NEW

MECHANICALLY OPERATED

FULL CIRCULATING NO-DRIP

SPRAY BAR

Again Littleford has Engineered a product to simplify the spraying of Asphalt, Tar, Emulsion, Road Oil and Cut-Back. The New Mechanically Operated No-Drip Spray Bar. It's the Spray Bar Contractors and Highway Departments have been waiting for. This New Mechanically Operated No-Drip Spray Bar circulates the entire length up to 24 ft. long, under pressure.

By simply pulling a lever all nozzles spray in unison, by pushing the lever all nozzles stop spraying instantly. No other valves or gadgets have to be turned on or adjusted.

Spraying can be done with any length of bar, one-half the bar, or any desired width, because each nozzle has its own individual valve. The Mechanically operated Spray Bar is "Lite-Wate", it weighs one third less than ordinary bars. It's end folding and one man can easily handle it. Quick acting couplings make the removal or addition of spray bar simple, quick and easy. This new Spray Bar is designed to fit either the "Spray-Master" or "Spray-King" Distributors and it's the most amazing development offered the Road Building industry in years.

Equipment with BUILT-IN ENGINEERING LITTLEFORD

LB LITTLEFORD

BLACK TOP ROAD MAINTENANCE EQUIPMENT SINCE - 1900

LITTLEFORD BROS., INC.

454 E. Pearl St., Cincinnati 2, Ohio

. . . for more details circle 195, page 16

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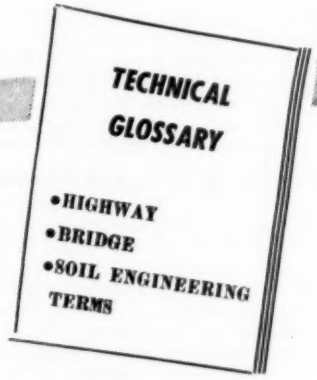
Special pre-publication offer will save you one third the cost of this valuable book



Here is a book you will want:

★ ***20,000 English-Spanish***
★ ***17,000 Spanish-English Technical Terms***

★ ***Prepared by U. S. Bureau of Public Roads***

★ ***Preparation Cost in Excess of $45,000***

TECHNICAL GLOSSARY is a much needed work for use in translating English technical material into Spanish, or Spanish technical material into English, in order to convey the exact same idea and meaning to the reader of either language.

THIS BOOK has been in process of preparation for a period of fifteen years. When it comes off the press the preparation cost will be in excess of $45,000.

The need of a specific glossary or dictionary of terms of this type has long been felt. After several International conferences between representatives of the U. S. Bureau of Public Roads and Latin American engineers, a decision was reached to prepare such a glossary. To further extend its usefulness, soil stabilization and associated laboratory work was included.

The manuscript for this book of over 35,000 terms was over 15 years in preparation under E. W. James, then Chief, Inter-American Regional Office, U. S. Bureau of Public Roads, working with the Library of Congress of the United States. It has been approved by a committee of five bilingual engineers of the Mexican government under the chairmanship of Sr. Ing. J. Fco. Rodríguez Cabo. It was then submitted to and approved by the "Academia Mexicana Correspondiente de la Academia Real Española" under the chairmanship of Sr. Don Martín Luis Guzmán, distinguished author, editor and publicist, also publisher of "El Tiempo."

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Crane/Draglines

•

One (1)
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Dragline
with Murphy Diesel Engine
75-Foot Boom
S/N 12717

•

One (1)
P & H Model 955
A. L. C. Dragline
with Waukesha Diesel Engine
70-Foot Boom
S/N 14979

•

Nine (9)
Euclid 22-ton
End Dump Trucks
powered with Cummins
275 Horsepower Diesel Engines

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Three (3)
Garwood Model 625
25-yard Scrapers

•

Five (5)
Euclid Single Engine Scrapers

•

A-C HD-20 Tractors
with Dozers and Push Plates

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Cats
D-4 D-6
D-7 D-8
Tractors

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Insley ½ yd. dragline.
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TRACTOR & EQUIPMENT CO.
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FOR SALE

2—300 CFM Ingersoll Rand Portable Air Compressors on wheels, good running condition ..... $450.00 Each

1—160 CFM Sullivan Portable Air Compressor on wheels, 1945 model, excellent working condition $450.00

1—5 Ton Cap. Kerry Crane, pneumatic tires $2,250.00

1—Hough Front End Loader, 1 yd. capacity, pneumatic tires, diesel driven, perfect working condition $2,500.00

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180 in.	8.25
360 in.	8.00

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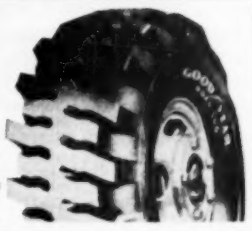

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From LS-90 Link Belt	$2,000.00
From 802 Lima	2,800.00
From 2000 Manitowoc	2,500.00
From 255-A P & H	2,250.00
From 655 P & H	2,000.00
From 20-B Bucyrus	1,250.00

Crane Booms

100' from 802 Lima	$2,250.00
70' from 750 Lima	1,500.00
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42' from ¾ yard crane	500.00
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Buckets

¾ yard PM dragline	$450.00
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2 yard Hayward Orange Peel	750.00
Two ¾ yd. dragline, each	350.00
1 yard ESCO dragline	600.00

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TWIN ENGINE EUCLID SCRAPERS FOR RENT

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KE. 5-1022

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Will discount AED rates to responsible parties.

D-4 w/1 c.y. hydraulic loader.

D-8 tractor & bulldozer.

No. 12 Cat motor patrol.

400 c.f. Cat diesel compressor.

10 ton, near new, truck crane, 3 drum, ideal for piling.

28 x 55' steel barge w/ 18 ton crane w/65' boom.

M-115 steel piling, random lengths.

4' x 8' concrete panel forms, lined.

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St. Paul 3, Minnesota

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- Forms easily compressible cushion
- Highly waterproof
- Low in cost

Made in 5 thicknesses – ¼", ⅜", ½", ¾" and 1" – in any length or width to meet job specifications. Formed between two sheets of heavy asphalt saturated felt paper, which increases strength and rigidity and improves handling.

Write for the complete Servicised Catalog. Describes the full line of Asphalt, Cork, and Rubber Composition Products.

SERVICISED PRODUCTS CORP.
6051 W. 65th ST. • CHICAGO, ILL.

. . . for more details circle 208, page 16

Manufacturers' Literature

(Continued from page 91)

All-Electric Shovel

A new member of the P&H electric shovel family is introduced in an 8-page, two-color bulletin just off the press. This machine, the P&H Model 1055-E, is similar in size to the standard 3¾-yd. P&H Model 1055, but is completely electric, driven by constant-speed AC motors throughout. Power transfer is through frictionless P&H magnetorque units for all shovel motions — swing, hoist, crowd, and propel. For a copy of this new bulletin, write Harnischfeger Corporation, Large Excavator Division, 4611 West National Avenue, Milwaukee 46, Wis. Ask for Bulletin X-162.

For more information circle 147 on Service Coupon Page 16 and mail now.

Scalping and Crushing Plant

A new bulletin No. 288 on Telsmith single pass scalping and crushing plant has been published by Smith Engineering Works, Box 723, Milwaukee, Wis. This highly mobile scalping and crushing plant for producing low cost road building aggregate is made for counties, townships and small crushing contracts. It can be moved quickly and easily from job to job. There is nothing to remove and traveling height is low. Simple to operate and can be controlled from the ground or from operator's platform and is recommended for jobs where finished product does not require grading.

For more information circle 148 on Service Coupon Page 16 and mail now.

Bituminous Distributors; Street Flushers

A new bulletin 54-4, released by Rosco Manufacturing Co., 3118 Snelling Ave., Minneapolis 6, Minn., describes the company's complete line of bituminous distributors, haul tanks, brooms and street flushers. It's pocket-sized, designed for quick reading and contains over 25 photo-illustrations of the company's line of road and street equipment. Short copy describes each unit and gives the sizes available for the various models. Included in this two color piece of literature is a picture of a road roller built in 9 and 13 wheel models and recently added to the Rosco line.

For more information circle 149 on Service Coupon Page 16 and mail now.

Concrete Mixer

A specification sheet (Bulletin 1240-S4) for the Blue Brute 6-S concrete mixer is available from the Advertising and Sales Promotion Department, Worthington Corporation, Harrison, N. J. The single sheet bulletin gives condensed specifications of the mixer, as well as standard and optional equipment available. Dimensions are graphically illustrated by a line drawing.

For more information circle 150 on Service Coupon Page 16 and mail now.

WHAT ABOUT YOU, MR. READER?

Are you still active in the field? Have you moved or changed your position?

Unless you send this information directly to us we can't be sure. Sometimes a reader's name is cut from the mailing list because we are not sure that our information as to name, title and address is right. *Your* name might be cut from the mailing list.

Don't Let This Happen to You

Even if you think we know all about you, please fill in the information requested below and send to us by return mail. Our auditors require proof of accuracy of our mailing list. *You* are the only person who can help us on this. Do it now before you forget, so you can be sure your magazine will always be properly addressed to you. New names cannot be added or old names retained on our list unless we have *all* this information. *Please print or type.*

DATE_____

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TITLE OR OCCUPATION

FIRM NAME OR GOVERNMENT DEPARTMENT (give street address)

CITY (If you have moved give *old and new* address) ZONE (if any) STATE

SIGNATURE

Truck Bodies and Hoists

A new 4-page, 2-color catalog, describing Galion Allsteel Model 12N-5 bodies and Model 800T, 880 and 77353 hydraulic hoists, has been announced by The Galion Allsteel Body Co., Galion, O. Illustrations include cut-away views, line drawings and action photos. Exclusive features of Galion products are described, with emphasis on construction features and mechanical details. Complete specifications are shown. Model 12N-5 bodies are offered in lengths of 11 to 14 ft. Hoist ratings range from 14 to 25 tons.

For more information circle 151 on Service Coupon Page 16 and mail now.

Money Making Features of Diesel Engine Applications

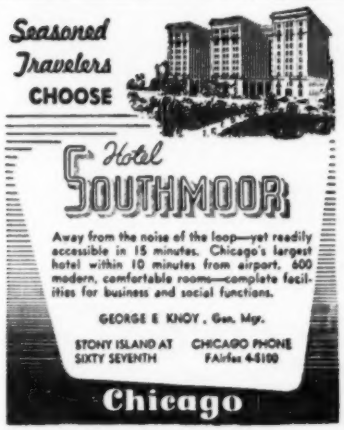
Eight money making features of a variety of diesel engine applications are described in a new booklet titled Cat Diesel Engines Plus Hydraulic Torque Converters (Form No. D457) published by Caterpillar Tractor Co., Peoria, Ill. This new 16-page booklet contains job descriptions and numerous photographs of some of the many applications where torque-converter-equipped diesel engines have proven themselves profitable. Included are descriptions of installations in various types of equipment such as locomotive cranes, drilling rigs, and shovels, and a complete chart of Cat diesel engines and their horsepower ratings.

For more information circle 152 on Service Coupon Page 16 and mail now.

Locating Troubles in Diesel Engines

A new "Maintenance Clinic" chart has been produced by Worthington Corporation entitled "Locating Troubles in the Diesel Engine." Designed as a handy reference for the operating engineer, the chart covers symptoms and possible causes of common troubles in lubrication, air system, fuel system, exhaust, settings and balance, water system, operation, etc. For further information and copy of chart, known as RP-739, write Advertising and Sales Promotion Department, Worthington Corporation, Harrison, N.J.

For more information circle 153 on Service Coupon Page 16 and mail now.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Away from the noise of the loop—yet readily accessible in 15 minutes. Chicago's largest hotel within 10 minutes from airport. 600 modern, comfortable rooms—complete facilities for business and social functions.
GEORGE E. KNOY, Gen. Mgr.
STONY ISLAND AT SIXTY SEVENTH
CHICAGO PHONE FAIrfax 4-6100
Chicago

with this WISCONSIN-POWERED UNIT!

This sturdy unit takes a six-foot-wide bite in any kind of snow, loading from 7 to 12 cubic yards of snow per minute in trucks or throwing it clear. Builder is Krause Industries, Baraboo, Wisconsin and the snow blower is constructed to mount easily and quickly on the Hough Payloader Tractor-Shovel. A Wisconsin Heavy-Duty Air-Cooled Engine provides the power.

Equipment builders and buyers are choosing Wisconsin Engines over all other types in the 3 to 36 hp. range . . . as the most satisfactory and foolproof power to fit both the *job* and the *machine*. You'll find a model and size available to fit every power requirement . . . 4-cycle single-cylinder, 2-cylinder and V-type 4-cylinder models, 3 to 36 hp. Write for Bulletin S-164.

WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 46, WISCONSIN

. . . for more details circle 219, page 16 A 8121-3

Now. . . . you can
RENT
THE
Neo-Flasher
BARRICADE
COMPLETE WITH
FLASHING LIGHT
AND BATTERY
FOR NO MORE THAN
THE OPERATING COST
OF ONE KEROSENE TORCH

NEO-FLASHER STEEL BARRICADE UNIT – MODEL A
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LIGHT PRODUCTS, INC.
407-c COMMERCIAL CENTER ST. • BEVERLY HILLS, CALIF.

. . . for more details circle 176, page 16

IMPROVED FRINK One-Way SNO-PLOW

No Other ONE-WAY SnowPlow throws and spreads like a FRINK

The moldboard has been redesigned with *INCREASED TAPER* and *CURVATURE*. The front end of the moldboard has been slightly lowered and the discharge end is higher and wider. As a result, snow is spread wider and farther than ever before, and thus does not form the high banks that encourage drifting.

The increased curvature plus the hinged deflector, which is standard on all models, prevents the snow from coming over the top even when speed plowing. When plowing at slow speeds, this extra curvature neatly rolls the snow into windrows.

This Sno-Plow is available in 3 sizes and is interchangeable with the Frink V-Type, Reversible Blade Type, Roll-Over Type Sno-Plows or Frink Roto-Broom, using the same truck attachments.

For further information on this Sno-Plow, write for catalog to nearest address, Box **R55412**

FRINK SNO-PLOWS

FRINK SNO-PLOWS, INC., CLAYTON, NEW YORK
DAVENPORT-BESLER CORP., DAVENPORT, IOWA
FRINK SNO-PLOWS of CANADA, LTD., TORONTO, ONT.

. . . for more details circle 180, page 16

With the Manufacturers and Distributors

NAMES OSGOOD-GENERAL MANAGER IN NORTHWEST. Don R. Williams, formerly sales manager for P. L. Cook & Co., Inc., Portland, Ore., distributors, has been appointed division sales manager for Oregon, Washington and British Columbia by Osgood-General, Marion, O.

A. R. MILBRATH RETIRES. A. F. Milbrath, 74, chief engineer and vice president of Wisconsin Motor Corporation, Milwaukee, Wis., has retired from active duty after 45 years of continuous service with the corporation.

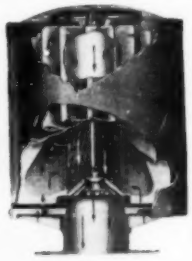
EUCLID APPOINTS TEXAS DISTRIBUTORS. Euclid Division, General Motors Corporation, Cleveland, O., has appointed three new dealer organizations to handle sales and parts service in Texas. These appointments include: In northeast Texas, Conley-Lott-Nichols Machinery Co., Dallas and Longview. In south Texas, Ingram Equipment Co. with headquarters in San Antonio and branches in Houston, Corpus Christi, Edinburg and Austin. In west Texas east of the Pecos River and the Pan Handle, Conley-Lott-Nichols Company of West Texas with headquarters in Lubbock and branch in Odessa.

WALTMAN NAMED MANAGER LESCHEN DIVISION. Herbert L. Waltman, heretofore manager of the Denver sales district, has been named manager of Pacific Northwest district for Leschen Wire Rope Division, H. K. Porter, Co., Inc. The district covers Washington, Oregon, western Idaho, Montana, and North Dakota, with headquarters in Seattle.

THEW SHOVEL ACQUIRES DIXIE CRANE. Thew Shovel Co., Lorain, O., has purchased controlling stock of Dixie Crane & Shovel Co., Inc., Harrisburg, Pa. Control of The Dixie Crane and Shovel Co. was acquired because Thew did not now participate in the low-cost crawler and rubber tire mounted, ¾ yd., 6-ton shovel-crane market. The Dixie Crane line will be continued to be manufactured and distributed by Dixie Crane, under that brand name.

"LET'S SPECIFY STAYNEW INTAKE FILTERS

They Give Us Positive Protection . . . They won't need Regularly Scheduled Maintenance . . . They're Easy to Clean on the Job . . . Efficient over a Wide Range of Loads They're not Affected by Temperature Change There's no Oil Carry-Over OUR EQUIPMENT WILL LAST LONGER!"



MODEL D
Intake Filter

Staynew Intake Filter's *Positive Protection* stops carbon accumulation and needless wear by keeping dust and dirt *out* of air intakes. And Staynew Filters frequently operate two or more years *without maintenance*. Specify Staynew and lengthen equipment life—increase productive time.

Write for Complete Booklet on Staynew Intake Filters.

Representatives in Principal Cities

DOLLINGER STAYNEW FILTERS

DOLLINGER CORPORATION
91 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

. . . for more details circle 177, page 16

EXPRESSWAYS SIGNING SERVICE ANNOUNCED. R. D. Loeffler, heretofore with the 3M New York branch, has been appointed sales engineer of toll roads and freeways by Minnesota Mining and Manufacturing Co., St. Paul, Minn. In this new position Mr. Loeffler will work with traffic planning engineers, freeway and toll road authorities, consultants and other planning traffic control sign and marking projects for expressways.

TAMPO NAMES NEW OFFICERS. Tampo Manufacturing Co., San Antonio, Tex. has completed a reorganization of its executive structure by naming 6 employees to positions as officers of the company. Walter Steves, president of Tampo since its organization, announced that Cleal Falke, formerly works manager, has been named vice-president and general manager. G. T. "Gus" Worthington, Eastern district representative, was named sales manager, and Robert "Bob" Samm was named superintendent of shops. Other promotions named J. E. Keppler to the post of chief engineer; J. D. Allbritton, purchasing agent; and F. "Red" Hudson, parts department manager.

ESCO APPOINTS NEW OFFICERS. Electric Steel Foundry Co., Portland, Ore., has appointed R. W. deWeese as vice president in charge of sales and Jefferson J. Davis as vice president in charge of product divisions.

NEW DISTRIBUTORS FOR HENSLEY. Hensley Equipment Co., Oakland, Calif., has appointed the following equipment stores as exclusive dealers in their area: Holz Co., Ukiah, Calif.; Westside Tractor & Equip. Co., Willows, Calif.; Emerson-Braden Co., Colusa, Calif.; Rosholt Equipment Co., Minneapolis, Minn.; Bark River Culvert & Equip. Co., Eau Claire, Wis.

UNSTAD MADE MANAGER TRUCK EQUIPMENT SALES. Leif Unstad, formerly manager Omaha Standard Body Company's, St. Paul, Minn., factory branch, has been appointed manager of Gar Wood Industries, Minneapolis, Minn., direct factory truck equipment sales branch.

HOUGH NAMES SALES ENGINEER. Jim Suter has been appointed sales engineer of The Frank G. Hough Co., Libertyville, Ill. In this position he will act as liaison between the sales department, Hough district representatives and other departments and will also be concerned with product improvement and development of the company's line of "Payloader" tractor-shovels and tractors.

NEW HEIL DISTRIBUTOR. Knoxville Structural Steel Co., Inc., 301 Morelia Ave., N. E., Knoxville, Tenn., has been named distributor for truck bodies and hydraulic hoists of The Heil Co., Milwaukee, Wis.

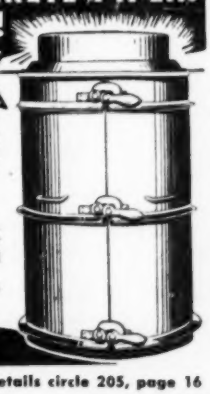
HYSTER NAMES NEW DISTRIBUTOR. Herd Equipment Co., 922 N. W. Fifth St., Oklahoma City, Okla., has been named industrial truck equipment dealer by Hyster Co., Portland, Ore., for entire state of Oklahoma.

IOWA MANUFACTURING CO. PROMOTES WICKE. Joe A. Wicke, heretofore assistant advertising manager of Iowa Manufacturing Co., has been promoted to advertising manager. Wm. E. Yount, Jr., has been advanced to assistant advertising manager.

HERRING APPOINTED DISTRICT MANAGER. Don L. Herring, formerly on sales staff of Square Deal Machinery & Supply Co., Orlando, Fla., has been appointed district manager of tractor equipment sales for Gar Wood Industries, Wayne, Mich. His headquarters will be in Atlanta, Ga.

FOR THE FINEST CONCRETE PIPE... YOU NEED FINEST FORMS!

THE Quinn Standard



Backed by over 40 years of reliable service, the QUINN STANDARD is recognized as the finest concrete pipe form the world over. Thousands of pipe manufacturers, from the smallest to the largest, look to Quinn for equipment to produce the finest concrete pipe at the lowest possible costs.

• QUINN HEAVY DUTY PIPE FORMS

For making pipe by hand methods by either the wet or semi-dry process. Sizes for pipe from 10" to 120" and larger. Tongue and groove or bell end pipe in any length desired.

WRITE TODAY for complete information and estimates.

Also manufacturers of QUINN CONCRETE PIPE MACHINES

Quinn WIRE & IRON WORKS
BOONE, IOWA

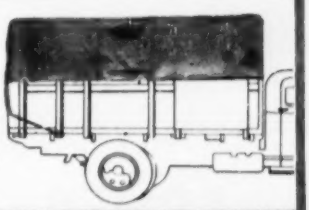
. . . for more details circle 205, page 16

PROTECTION ✓
EFFICIENCY ✓
for your
CITY

Shuredry
SALVAGE COVERS
for your
Fire Department

Cut water and smoke damage with SHUREDRY Green-Bak Salvage Covers — they're pressure impregnated by an exclusive Fulton dry-treatment process. All seams are waterproof. SHUREDRY Covers are light, pliable and easy to handle. Specify SHUREDRY — your Fire Equipment Dealer has them.

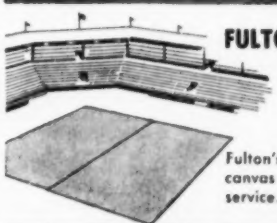
FULTON COVERS
for your
Sanitation Trucks



Fulton makes a complete line of top quality Tarpaulins and Truck covers in any size you need.

Fulco
CONCRETE
CURING MATS for
your Road Department

Fulco Mats produce a more uniform paving job, minimize the possibility of cracks and do in 72 hours what took about 10 days under the wet-burlap-wet-earth method. Fulco Mats can be used 50 to 75 times. They're economical.



FULTON COVERS AND TARPS
for your Softball
Baseball
and Football Fields

Fulton's special treatment of the heavy canvas duck, assures long, economical service.

Write your nearest Fulton branch for information and prices.

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LOS ANGELES • MINNEAPOLIS • NEW ORLEANS • NEW YORK
OKLAHOMA CITY • PHOENIX • ST. LOUIS • SAN FRANCISCO
SAVANNAH • WINTER HAVEN

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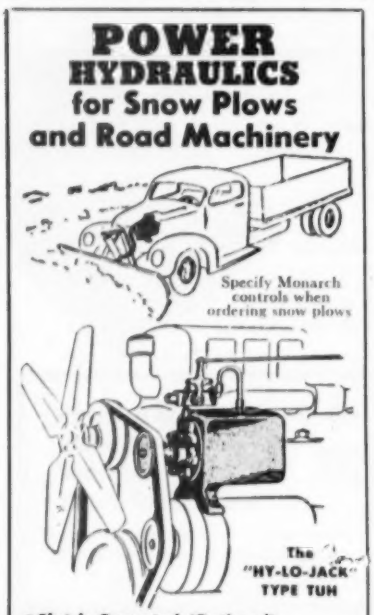

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GM DIESEL
CASE HISTORY NO. 5312-118

USER: Macco Corporation, Paramount, California.

INSTALLATION: GM Diesel-powered Ingersoll-Rand and Chicago Pneumatic rotary compressors supply air for Guniting riverbanks and earthquake-damaged building walls.

PERFORMANCE: Macco has standardized on GM Diesel-powered rotary compressors. Charles D. Dutro, Superintendent of Guniting Construction, reports steadier air, more positive pressure, gets 25% more work done than with other compressors. No repairs since units were installed more than a year ago.

It pays to STANDARDIZE on GM

GM
GENERAL MOTORS
DIESEL POWER

"25% more work done"

with GM Diesel-powered Rotary Compressors

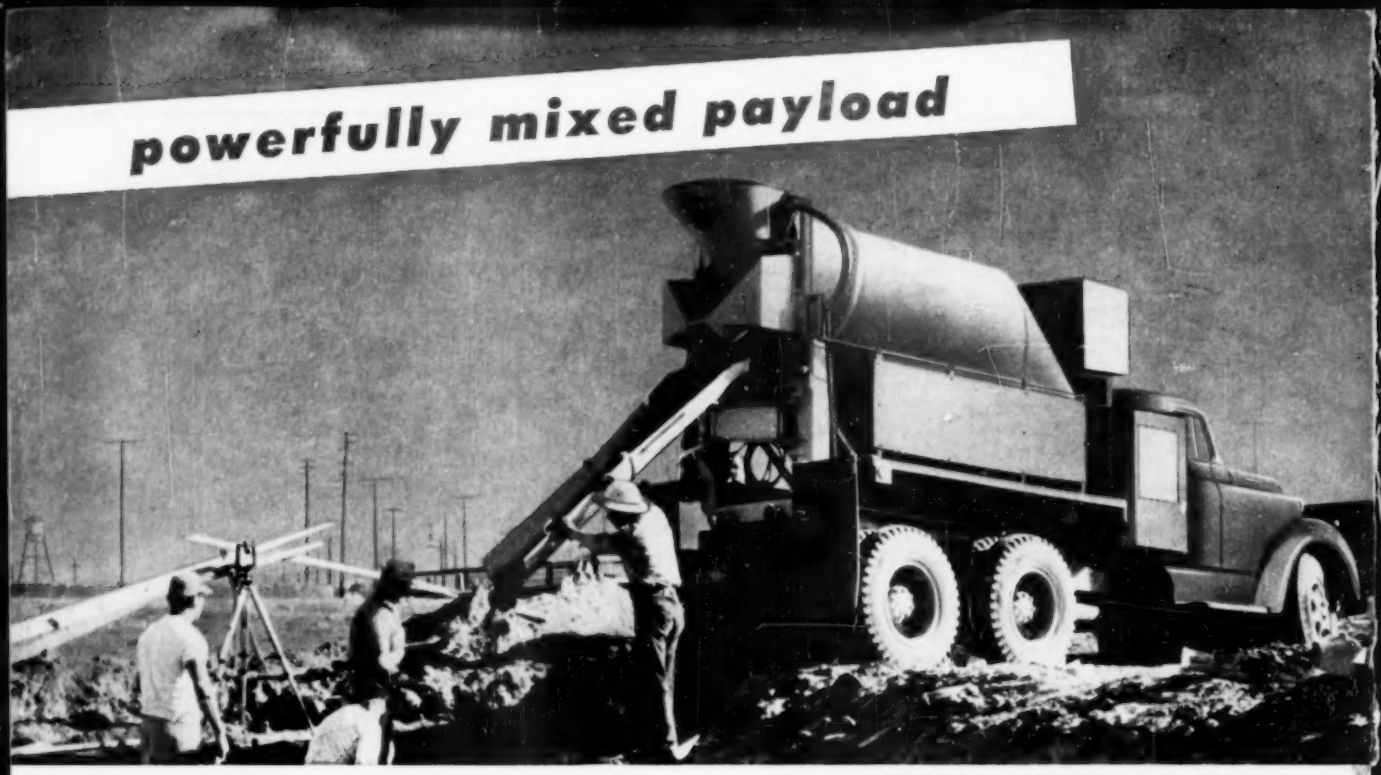
25% more work done per shift—steadier, more positive pressure—high portability—these are some of the reasons why Macco Corporation has standardized on General Motors Diesel-powered rotary compressors for their Guniting work. They report smoother operation and faster, easier moves.

Quick-acting GM 2-cycle Diesels pack more power in less space, so for building jobs Macco mounts the compressors on light trucks for faster trips. In intermittent compressor operation—and in every other kind of work—precision unit fuel injectors keep fuel consumption down. Contractors tell us that GM Diesels run for years without overhaul, but when parts and service *are* needed they are always quickly available.

More and more contractors are standardizing on modern rotary compressors designed around quick-accelerating GM 2-cycle Diesel engines. For more details on GM Diesel-powered compressors for your job, call your nearest distributor or write:

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN
Single Engines... 30 to 300 H.P. Multiple Units... Up to 864 H.P.

. . . for more details circle 183, page 16



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CHRYSLER POWER PARTNERS *help contractors break records, save on equipment while doing so*

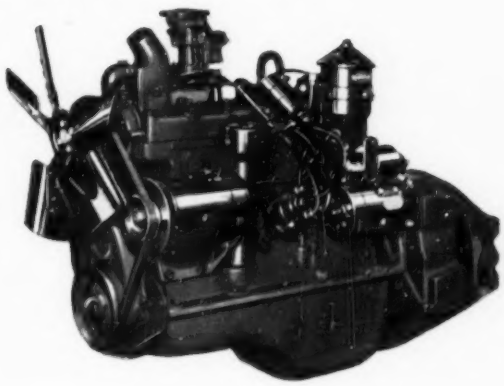
This year promises to be a record year in highway construction. From coast to coast States are busy building super highways, planning others. Construction equipment was never busier, top-performing equipment never more important.

Here's a T. L. Smith 5½-yard Deluxe Mixer pouring concrete for a pier on a Los Angeles expressway. Behind its capable performance is a Model 30 Chrysler Industrial Engine. At 230 cubic inches piston displacement, Chrysler Model 30 Engine with chain drive front end offers high-speed performance in a package small enough to permit the largest possible payload.

Chrysler gýrol Fluid Coupling transmits power from driving to driven members, smoothing out the jarring shocks of clutching and declutching, improving performance and extending life of equipment, engine and transmission.

Whether your equipment requires gasoline, natural or L-P gas burning carburetor engines, gear or chain drive front-ends, gýrol Fluid Coupling, Chrysler torque converter, 3, 4 or 5-speed transmission, vertical or horizontal magnetos, Chrysler can supply industrial engines equipped to your needs. And since Chrysler production-line methods are adapted to specialized industrial engine building, custom-built engines are provided at mass-production prices.

For your needs see a Chrysler Industrial Engine Dealer or write: ***Dept. 1112, Industrial Engine Division, Chrysler Corporation, Trenton, Michigan.***



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